

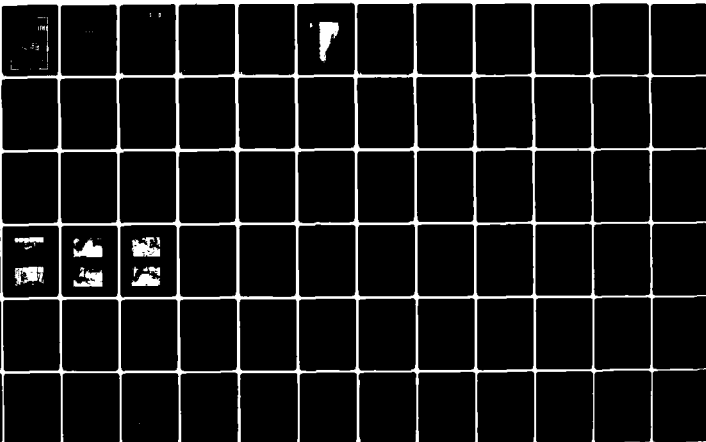
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BERGER ASSOCIATES INC HARRISBURG PA
NATIONAL DAM INSPECTION PROGRAM. LOWER BIRCHWOOD LAKE DAM (NDI --ETC(U)
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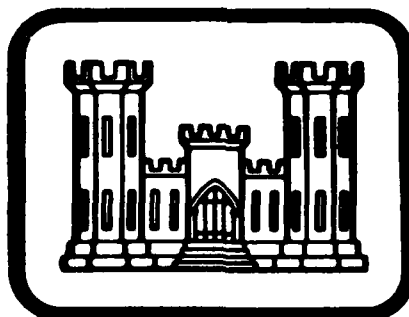
**DELAWARE RIVER BASIN
LOWER BIRCHWOOD LAKE DAM**

NDI NO. PA-00403
DER NO. 52-145

LEVEL II

PIKE COUNTY, PENNSYLVANIA

**PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM**



**DTIC
ELECTE**
AUG 15 1980
F

PREPARED FOR
DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

BY
Berger Associates, Inc.
Harrisburg, Pennsylvania
JUNE 1980

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In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM
BRIEF ASSESSMENT OF GENERAL CONDITIONS
AND RECOMMENDATIONS

Name of Dam: LOWER BIRCHWOOD
State & State No.: PENNSYLVANIA, 52-145
County: PIKE
Stream: TRIBUTARY TO DINGMANS CREEK
Date of Inspection: April 1, 1980

Based on the visual inspection, past performance and the available engineering data, the dam and its appurtenant structures appear to be in fair condition.

In accordance with the Corps of Engineers' evaluation guidelines, the size classification of this dam is small and the hazard classification is high. These classifications indicate that the Spillway Design Flood (SDF) for this dam should be in the range of one-half the Probable Maximum Flood (PMF) to the full PMF. The recommended SDF for this dam is one-half of the PMF. Since the spillway discharge capacity and reservoir storage capacity are capable of passing 50% of a PMF without overtopping, the spillway is considered to be adequate.

The following recommendations are presented for immediate action by the owner:

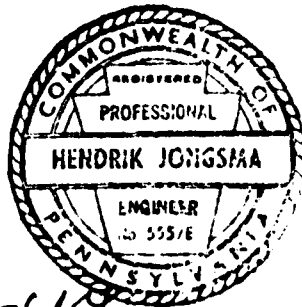
1. That all brush and trees be removed from the embankment slopes and that a professional engineer, experienced in the design and construction of dams, be consulted for the removal of tree stumps and roots.
2. That the drawdown facilities be operated and maintained at least once each year.
3. That surface water be drained away from the toe of the dam.
4. That fill be placed to design crest elevation on both sides of the spillway at the upstream side.

5. That a formal surveillance and downstream warning system be developed for use during periods of high or prolonged precipitation.
6. That an operation and maintenance manual be prepared for guidance in the operation of the dam during normal and emergency condition, and that a schedule be developed for the annual inspection of the dam and its appurtenant structures.

SUBMITTED BY:

BERGER ASSOCIATES, INC.
HARRISBURG, PENNSYLVANIA

DATE: June 19, 1980



A handwritten signature in black ink, appearing to read "H. Jongsmma", written over the bottom of the professional seal.

APPROVED BY:

A handwritten signature in black ink, appearing to read "James W. Peck", written over the printed name and title.

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer
DATE 7/1/80



OVERVIEW

JOSEPH RICHMOND LANE DAM

RECONSTRUCTION

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(6) PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

LOWER BIRCHWOOD LAKE DAM

(NDI-ID 16/PA-00403)

DER-ID NO 52-145

Dike County, Pennsylvania, Delaware River Basin
I Inspection Report

SECTION I - PROJECT INFORMATION

1.1 GENERAL

A. Authority

The dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspections of dams throughout the United States.

B. Purpose

The purpose of this inspection is to determine if the dam constitutes a hazard to human life and property.

1.2 DESCRIPTION OF PROJECT

A. Description of Dam and Appurtenances

Lower Birchwood Lake Dam is an earthfill structure with a maximum embankment height of 12 feet. The alignment of the approximately 1000 foot long crest is curved. (Plate A-1, Appendix A). The spillway is located in the right abutment and consists of a 25 foot long concrete ogee section. Nine-inch high flashboards have been installed on top of the ogee section. The drawdown facilities consist of an 18-inch corrugated metal pipe encased in concrete. The outflow through the pipe is controlled at the upstream end with a sloping slide gate.

B. Location:

Delaware Township, Pike County
U.S.G.S. Quadrangle - Lake Maskenozha,
Pennsylvania - New Jersey
Latitude 41°-14.6", Longitude 74°-55.2"
Appendix E, Plates I & II

C. Size Classification:

Small: Height - 12 feet
Storage - 226 acre-feet

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- D. Hazard Classification: High (Refer to Section 3.1.E.)
- E. Ownership: Mr. Hugh McGrane, Board of Director
Birchwood Lakes Community
Association, Inc.
Dingmans Ferry, PA 18328
- F. Purpose: Recreation
- G. Design and Construction History

The facilities were designed by Mr. Edward C. Hess, P.E., Stroudsburg, Pennsylvania. A permit for construction was issued by the Pennsylvania Department of Environmental Resources (PennDER) on June 18, 1958. A final construction inspection by PennDER was made on April 28, 1960.

H. Normal Operating Procedures

The design crest elevation of the spillway weir has been raised nine inches by the installation of flashboards. All inflow above the top of these boards is discharged through the spillway channel. The emergency drawdown gate has not been operated by the present owners since they obtained the facility in 1975. It is unknown when the gate was last opened.

1.3 PERTINENT DATA

A. Drainage Area (square miles)

From files:	.9
Computed for this report:	.97
Use:	.97

B. Discharge at Dam Site (cubic feet per second)
See Appendix D for hydraulic calculations

Maximum known flood, July 1969, estimated from records for the U.S.G.S. gaging station located on nearby Mill Creek	402
Outlet works: low-pool outlet at pool Elev. 1015	14
Outlet works at pool level Elev. 1022.75 (spillway crest)	28

Spillway capacity at pool Elev. 1025.9
(top of dam)

Without Flashboard	747
With Flashboard	461

C. Elevation (feet above mean sea level)

Top of dam (design crest)	1026.0
Top of dam (low point)	1025.9
Spillway crest (design - normal pool)	1022.0
Spillway crest (top of flashboards)	1022.75
Upstream portal centerline (sluice gate opening)	1012.1
Downstream portal invert	1010
Streambed at centerline of dam - estimate	1014

D. Reservoir (miles)

Length of normal pool	0.5
Length of maximum pool	0.5

E. Storage (acre-feet)

Spillway crest (Elev. 1022.75)	98
Top of dam (Elev. 1025.9)	226

F. Reservoir Surface (acres)

Top of dam (Elev. 1025.9)	43.9
Spillway crest (Elev. 1022.75)	38.4

G. Dam

Refer to Plate III and IV in Appendix E for plan and section.

Type: Earthfill.

Length: 1000 feet.

Height: 12 feet.

Top Width: As surveyed - Varies 12.5 to 14.5 feet.
Design - 10 feet.

Side Slopes: Upstream - 2.1H to 1V (as surveyed).
Downstream - 3.4H to 1V (as surveyed).

Zoning: None.

Cutoff: Trench excavated on centerline of dam and backfilled with selected impervious material. Minimum trench depth is 4 feet, bottom width is 8 feet.

Grouting: None.

H. Outlet Facilities

Type: 18" CMP encased in concrete.

Location: Near center of dam.

Closure: 18" slide gate on upstream end. .

I. Spillway

Type: Concrete ogee weir with flashboard.

Location: Right abutment.

Length of Weir: 25 feet.

Crest Elevation: Ogee - 1022
Top of flashboard - 1022.75

Downstream Channel: Stone lined trapezoidal channel.

J. Emergency Outlet

See Section 1.3.H. above.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

The engineering design data for Lower Birchwood Dam is limited. The available material consists of the "Report Upon the Application" for a permit to construct the dam and two construction drawings. The report, filed on June 5, 1958, and written by PennDER, indicates that the spillway capacity was calculated to be 734 cfs based on a 4 foot deep flow over the spillway.

The two construction drawings (Plate III and IV, Appendix E) are the only other available engineering data for this dam. Design calculations, test boring results and stability analysis are not available for review.

2.2 CONSTRUCTION

The construction data is limited to a copy of the construction specifications and bid proposal. Records of construction and "As Built" plans are not available in the files of PennDER or with the owner.

2.3 OPERATION

Formal records of operation have not been maintained by the owner. Ownership was transferred from Benewater Lodge Inc., the original owner, to All American Realty Co., Inc., in 1962. This company transferred ownership to the present owners in 1975.

2.4 EVALUATION

A. Availability

The construction drawings and construction specifications are in the files of PennDER.

B. Adequacy

The construction drawings, combined with the visual inspection of the dam and its appurtenant structures are considered adequate for making a reasonable assessment of the condition of the dam.

C. Operating Records

Operating records, including maximum pool levels are not maintained by the owners.

D. Post Construction Changes

Records of modifications made to the facilities are not available. The installation of the flashboards on the ogee section has probably occurred in the mid 1960's. The files of PennDER do not contain reference to this installation.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

A. General

The general appearance of the Lower Birchwood Lake Dam is fair. The embankment slopes appear to be stable and adequate. Brush and trees are however present on the upstream side of the embankment over its full length and on the right end of the downstream slope. The condition of the spillway appears to be good. Flashboards have been installed on the spillway crest and apparently have been there for many years. Several wet areas were noticed along the downstream toe of the dam. The reservoir was created as a recreational attraction for a large residential development around the lake. The reservoir is located downstream of three other small reservoirs in the same development. Mr. Hugh McGrane represented the owners and accompanied the inspectors. The visual inspection check list is in Appendix A of this report. Sketches of a general plan, profile and typical cross sections as surveyed during the inspection are presented in Appendix A as Plates A-I, A-II and A-III.

Photographs taken of the facilities on the day of the inspection are reproduced in Appendix C.

B. Embankment

The upstream slope is protected by dumped riprap to the crest elevation of the dam. The upstream slope has a heavy growth of Birch trees over the full length of the dam (see Photographs No. 2, 3 & 4, Appendix C). This growth is considered undesirable for an earthfill dam. Some erosion of the upstream slope has occurred immediately adjacent to both sides of the spillway (Photograph No. 7). Although cutoff walls are preventing further erosion, it is recommended to place fill in these areas.

The crest of the dam has a grass cover over most of its length, but several areas are bare due to cars driving on the dam crest.

The downstream slope is relatively flat and has a good grass mat cover over most of its length. Heavy brush has been permitted to grow in an area from the spillway to about 400 feet left of the spillway. The slopes appeared to be stable and no sloughs or seepage was detected.

The immediate downstream area of the dam is flat and appears to drain toward the toe of the dam about halfway between the two abutments. On the day of inspection, an eight-inch deep pool of water was noted in

this area (Photograph No. 6). It is recommended that this surface water be drained away from the toe of the dam. The horizontal alignment of the dam is curved (see Plate A-I). The vertical profile of the crest of the dam, as surveyed during this inspection, (Plate A-II) indicates that the top of the dam, with the exception of one area adjacent to the right spillway wall, is at least 0.3 feet higher than the design crest elevation.

C. Appurtenant Structures

The concrete ogee type spillway is located in the right abutment. The concrete of the weir, the downstream slab and the abutment walls were in good condition. Ten feet long cutoff walls are located on the centerline of the dam on both sides of the spillway. The discharge channel is a U-shaped channel formed with loose handlaid vertical walls and a loose stone bottom. The appearance of the channel was good. Trees and brush close to the walls should be removed to prevent displacement of these walls. About 500 feet below the dam, the channel discharges through an 8' x 5.5' high culvert located under a state highway.

The normal pool of the reservoir has been raised nine inches by the installation of flashboards on top of the weir. The flashboards are supported by two-inch diameter pipes which will not collapse with a high discharge.

The drawdown facilities consists of an 18-inch diameter conduit controlled at its upstream end by means of a sloping slide gate. The control for the gate is located at the upstream side of the embankment crest. The gate has not been operated for at least five years. The last time it was opened is unknown. The conduit discharges at the downstream toe into a stone-lined channel which joins the main channel about 200 feet downstream from the toe. The conduit exit is protected with a concrete headwall and wingwalls.

D. Reservoir Area

The reservoir is surrounded by woodlands on moderate slopes. Many homes and cottages are located in the woods. The banks are stable. At the upstream end of the Lower Birchwood reservoir is the dam for the Upper Birchwood Lake. This dam has a spillway. Two other reservoirs are located upstream from Lower Birchwood. The Middle Birchwood Lake discharges through a 24-inch standpipe with a 14-inch pipe directly into the Lower Birchwood Lake. The East Birchwood Lake discharges into the Upper Birchwood Lake through a 24-inch standpipe and pipe and then into Lower Birchwood.

E. Downstream Channel and Area

Three homes are located immediately downstream from the dam in the area between the dam and the highway. These homes are near the left

abutment. The downstream channel joins the Dingmans Creek just below the Highway arch culvert. About a quarter mile further downstream, Dingmans Creek runs through Childs State Park with extensive picnic grounds near the stream channel. A potential hazard to loss of life exists downstream if the dam fails. The hazard category is therefore considered to be "High".

3.2 EVALUATION

The overall visual evaluation of the facilities indicates that the dam is only in fair condition mostly as the result of poor maintenance practices. Recommendations include the removal of brush and trees from the slopes and along the spillway walls, the regular opening of the emergency sluice gate, and providing of surface drainage of the immediate downstream area.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

The operational procedures at Lower Birchwood Dam are limited. The reservoir is used for recreation and the pool level is maintained at the elevation of the flashboards on top of the spillway weir. Any additional inflow is discharged over the flashboards.

4.2 MAINTENANCE OF DAM

The left end of the embankment and downstream area is adjacent to a beach area and the entrance into the development. This area appears to be regularly mowed and is in good condition. The right end of the embankment is not maintained and has a heavy growth of brush and some trees. The exposed upstream slope is covered with birch trees along its entire length.

4.3 MAINTENANCE OF OPERATING FACILITIES

The sliding gate on the drawdown conduit is the only operable equipment. This gate has not been opened in at least 5 years. The wheel or crank to operate the gate is missing.

4.4 WARNING SYSTEM

A formal surveillance and downstream warning system does not exist at the present time.

4.5 EVALUATION

The operational procedures for these facilities should include the removal of all trees and brush from the embankment and in an area 10 feet beyond the toe of the dam. The sliding gate should be operated and greased at least once each year to ensure its operable condition in case of an emergency.

A formal surveillance plan and downstream warning system should be developed for implementation during periods of high or prolonged precipitation.

SECTION 5 - HYDROLOGY/HYDRAULICS

5.1 EVALUATION OF FEATURES

A. Design Data

The hydrologic and hydraulic data available from the PennDER files for Lower Birchwood Lake Dam was limited to comments by PennDER in the permit application report. No area-capacity curve, frequency curve, unit hydrograph, design storm, design flood hydrograph, nor flood routings were available.

B. Experience Data

There are no records of flood levels at Lower Birchwood Lake Dam. Based on records of the U.S.G.S. stream gage on Mill Creek at nearby Mountainhome, Pennsylvania, the maximum inflow of Lower Birchwood Lake Dam is estimated to be 402 cfs. The dam passed this flood event without difficulty.

C. Visual Observations

On the date of the inspection, no conditions were observed that would indicate that the appurtenant structures of the dam could not operate satisfactorily during a flood event, until the dam is overtopped. It was noted that the flashboards were double wooden boards and appeared to be installed securely. This would tend to inhibit the possibility of flashboard failure and reduce the discharge capacity from the design capacity. Upstream of Lower Birchwood Lake Dam are three small lakes. Only one of these was considered to have an effect on the downstream lake and was included in the hydrologic computations (Appendix D).

D. Overtopping Potential

Lower Birchwood Lake Dam has a total storage capacity of 226 acre-feet and an overall height of 12 feet above streambed. These dimensions indicate a size classification of "Small". The hazard classification is "High" (See Section 3.1.E.).

The recommended Spillway Design Flood (SDF) for a dam having the above classifications is in the range of one-half the Probable Maximum Flood (PMF) to the full PMF. Because of the very small size of this dam, a SDF of one-half PMF is recommended. For this dam, the SDF peak inflow is 611 cfs (see Appendix D for HEC-1 inflow computations).

Comparison of the estimated SDF peak inflow of 611 cfs with the estimated spillway discharge capacity of 461 cfs with flashboards and 747 cfs without flashboards indicates that a potential for

overtopping of the Lower Birchwood Lake Dam exists with the flashboards in place.

An estimate of the storage effect of the reservoir and routing of the computed inflow hydrograph through the reservoir shows that this dam has the necessary storage available to pass the SDF without overtopping. The spillway-reservoir system can pass a flood event equal to 50% of a PMF with the flashboards in place and 66% of a PMF with the flashboards removed.

E. Spillway Adequacy

The small size category and high hazard category, in accordance with the Corps of Engineers criteria and guidelines, indicates that the SDF for this dam should be in the range of one-half the PMF to the full PMF. The recommended SDF for this dam is one-half the PMF.

Calculations shows that the spillway discharge capacity and reservoir storage capacity are capable of handling 50% of the PMF when the flashboards are intact. With the flashboards removed, Lower Birchwood Lake Dam has sufficient spillway discharge capacity and reservoir storage capacity to handle 66% of a PMF.

Since the spillway discharge and reservoir storage capacity can pass the SDF (one-half PMF) without overtopping, the spillway capacity is judged to be adequate.

The hydrologic analysis for this investigation was based upon existing conditions of the watershed. The effects of future development were not considered.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

A. Visual Observations

1. Embankment

The visual inspection of Lower Birchwood Dam did not detect any signs of embankment instability. The field survey indicates an upstream slope slightly flatter than the design slope. The downstream slope is flatter than 3H to 1V and is considered adequate for this height of embankment. The profile of the crest of the dam indicates a present elevation slightly higher than the design crest except near the right spillway wall.

2. Appurtenant Structures

The spillway in the right abutment appeared to be in good condition. The concrete surfaces were smooth and the walls did not show signs of undue stresses or instability. The spillway outlet channel was formed with handlaid loose stone walls and slab and appeared to be in good condition. The slide gate for the drawdown outlet is located on the submerged upstream slope and could not be inspected. The gate control on the top of the dam appeared to be in good condition. It could not be operated due to the absence of the crank handle or wheel.

B. Design and Construction Data

The construction drawings and specifications indicate that topsoil beneath the embankment was removed and that a cutoff trench was excavated along the centerline of the dam. An impervious material was used for trench backfill and embankment fill. The specifications directed that the more pervious material be placed on the outside. The fill was to be placed in six-inch layers and was to be compacted with a sheepsfoot roller. A dumped riprap layer was placed on the upstream slope. Toe drains are not indicated.

The ogee section and spillway walls were placed on impervious material and are unreinforced concrete sections. The sections appear to be adequate for the indicated heights. Cutoff walls were placed in the embankment fill and at the end of the spillway slab. The outlet pipe is encased in concrete and has two anti-seepage collars.

C. Operating Records

Operating records for this dam have not been maintained.

D. Post Construction Changes

Nine-inch high flashboards have been installed on top of the spillway ogee section. These flashboards are non-collapsible and reduce the effectiveness of the spillway design capacity.

E. Seismic Stability

This dam is located in Seismic Zone 1 and it is considered that the static stability is sufficient to withstand minor earthquake-induced dynamic forces. No studies or calculations have been made to confirm this assumption.

SECTION 7 - ASSESSMENT AND RECOMMENDATIONS

7.1 DAM ASSESSMENT

A. Safety

The visual inspection and the review of the available design and construction data indicate that Lower Birchwood Dam is in fair condition. The design of the dam appears to be adequate and the inspection did not detect any signs of instability or seepage that could indicate an unsafe condition. Improved maintenance practices are required to ensure continued safe operation of the facilities.

The hydrologic and hydraulic computations indicate that the combination of reservoir storage capacity and the spillway discharge capacity are adequate to pass 50 percent of the PMF with the present flashboards. Therefore, the spillway is considered to be adequate.

B. Adequacy of Information

The design and construction information contained in the files of PennDER, combined with the visual inspection, are considered to be adequate for making a reasonable assessment of this dam.

C. Urgency

The recommendations presented below should be implemented immediately.

D. Additional Studies

Additional studies are not required at this time.

7.2 RECOMMENDATIONS

In order to assure the continued satisfactory operation of this dam, the following recommendations are presented for immediate implementation by the owner:

1. That all brush and trees be removed from the embankment slopes and that a professional engineer, experienced in the design and construction of dams, be consulted for the removal of tree stumps and roots.
2. That the drawdown facilities be operated and maintained at least once each year.

3. That surface water be drained away from the toe of the dam.
4. That fill be placed to design crest elevation at both sides of the spillway at the upstream side.
5. That a formal surveillance and downstream warning system be developed for use during periods of high or prolonged precipitation.
6. That an operation and maintenance manual be prepared for guidance in the operation of the dam during normal and emergency conditions, and that a schedule be developed for the annual inspection of the dam and its appurtenant structures.

APPENDIX A
CHECKLIST OF VISUAL INSPECTION REPORT

CHECK LIST

PHASE I - VISUAL INSPECTION REPORT

PA DER # 52-145

NDI NO. PA-00403

NAME OF DAM LOWER BIRCHWOOD HAZARD CATEGORY High

TYPE OF DAM Earthfill

LOCATION Delaware TOWNSHIP Pike COUNTY, PENNSYLVANIA

INSPECTION DATE 4/1/80 WEATHER Sunny TEMPERATURE 45

INSPECTORS: R. Houseal (Recorder)

OWNER'S REPRESENTATIVE(s):

H. Jongsma

Hugh McGrane

R. Shireman

A. Bartlett

NORMAL POOL ELEVATION: 1022.0* AT TIME OF INSPECTION:

BREAST ELEVATION: 1026.0 (design)
1022.75 (present)

POOL ELEVATION: 1022.92*

SPILLWAY ELEVATION: 1022.0 (design)

TAILWATER ELEVATION:

MAXIMUM RECORDED POOL ELEVATION: No records

GENERAL COMMENTS:

*Normal pool at present is 1022.75 due to the installation of 9-inch high flashboards.

Immediately upstream from Lower Birchwood Lake is the dam for Upper Birchwood Lake with a pool level at Elev. 1041±.

VISUAL INSPECTION
EMBANKMENT

	OBSERVATIONS AND REMARKS
A. SURFACE CRACKS	None observed.
B. UNUSUAL MOVEMENT BEYOND TOE	None observed.
C. SLOUGHING OR EROSION OF EMBANKMENT OR ABUTMENT SLOPES	None observed.
D. ALIGNMENT OF CREST: HORIZONTAL: VERTICAL:	Horizontal Alignment - curved (by design). Vertical Alignment - See profile in Appendix A, Plate A-II.
E. RIPRAP FAILURES	None evident. Riprap on upstream slope.
F. JUNCTION EMBANKMENT & ABUTMENT OR SPILLWAY	Some erosion of fill has occurred on the up- stream side of the cutoff walls at the spillway abutment walls. Some backfill is required. The left embankment junction is good.
G. SEEPAGE	Free water was observed beyond the toe of the downstream slope (8" deep) near the center of the dam. Surrounding topo drains directly to this area.
H. DRAINS	None observed.
J. GAGES & RECORDER	None.
K. COVER (GROWTH)	Upstream slope heavy growth of birch trees from crest to water's edge. 2"-4" dia. Riprap. Crest and downstream slope grassed, mowed, good appearance. Wheel track on crest. Some heavy brush on downstream slope near right abutment.

NDI NO. PA-00 403

VISUAL INSPECTION
OUTLET WORKS

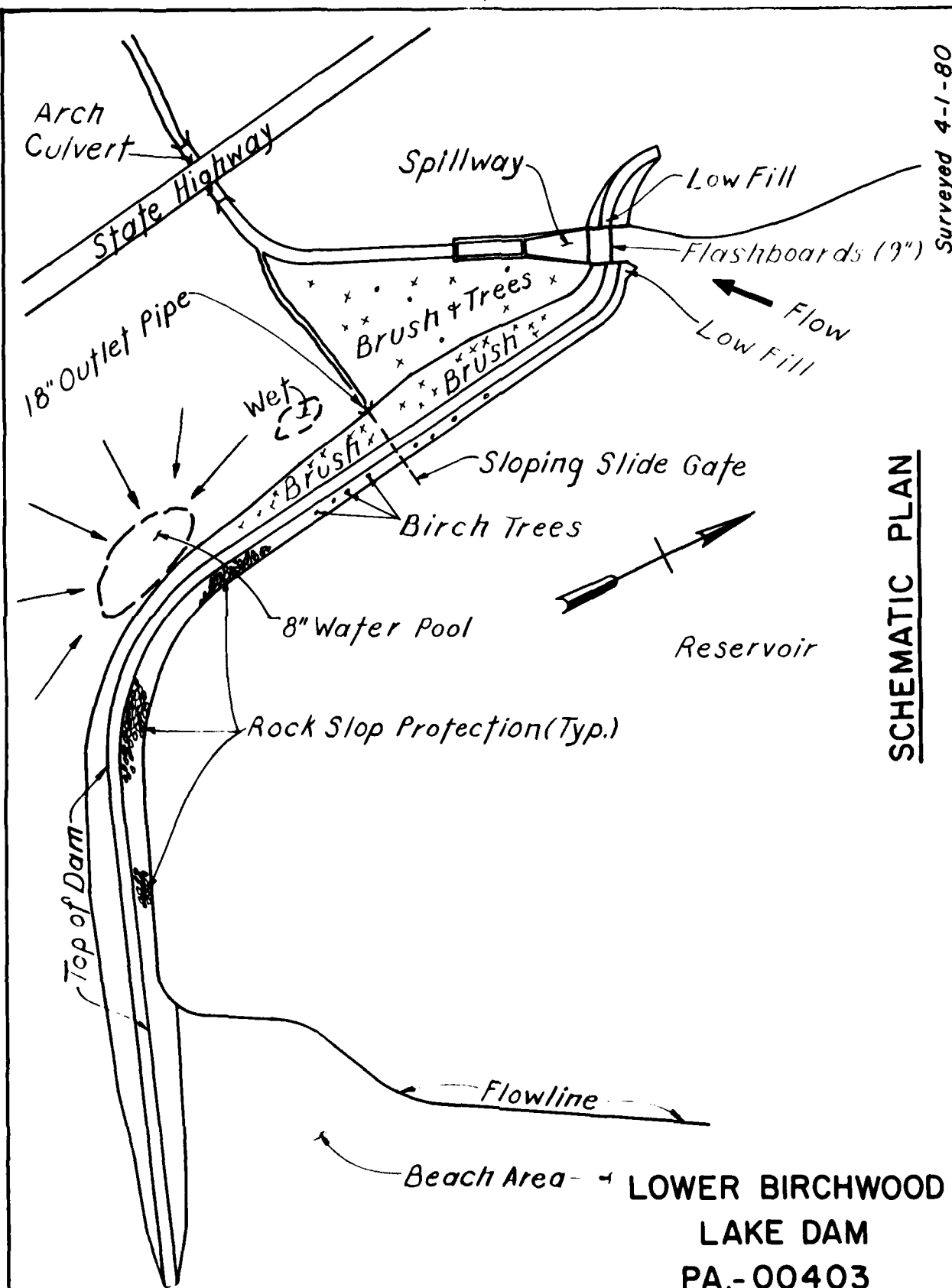
	OBSERVATIONS AND REMARKS
A. INTAKE STRUCTURE	Sloping slide gate on 18" outlet pipe submerged.
B. OUTLET STRUCTURE	18" CMP at toe of downstream slope with concrete end walls. 6-inch silt accumulation in the outlet pipe.
C. OUTLET CHANNEL	Open channel directed to the spillway channel. Rock lined.
D. GATES	Sloping gate on upstream slope. Control at upstream edge of embankment. Gate is submerged and not visible.
E. EMERGENCY GATE	Section D above.
F. OPERATION & CONTROL	No records. Not used since at least 1975.
G. BRIDGE (ACCESS)	None.

VISUAL INSPECTION
SPILLWAY

	OBSERVATIONS AND REMARKS	
A. APPROACH CHANNEL	The approach to the spillway is directly from the reservoir area. Unobstructed. Located at right abutment.	
B. WEIR: Crest Condition Cracks Deterioration Foundation Abutments	2" water over spillway raised with 9" flashboards on crest. Length 25.1 feet. Slab 18 feet in length. Weir is round crested.	All in good condition. Concrete walls in good condition.
C. DISCHARGE CHANNEL: Lining Cracks Stilling Basin	Stone lined walls - hand laid. No stilling basin.	
D. BRIDGE & PIERS	None.	
E. GATES & OPERATION EQUIPMENT	None.	
F. CONTROL & HISTORY	No records.	

VISUAL INSPECTION

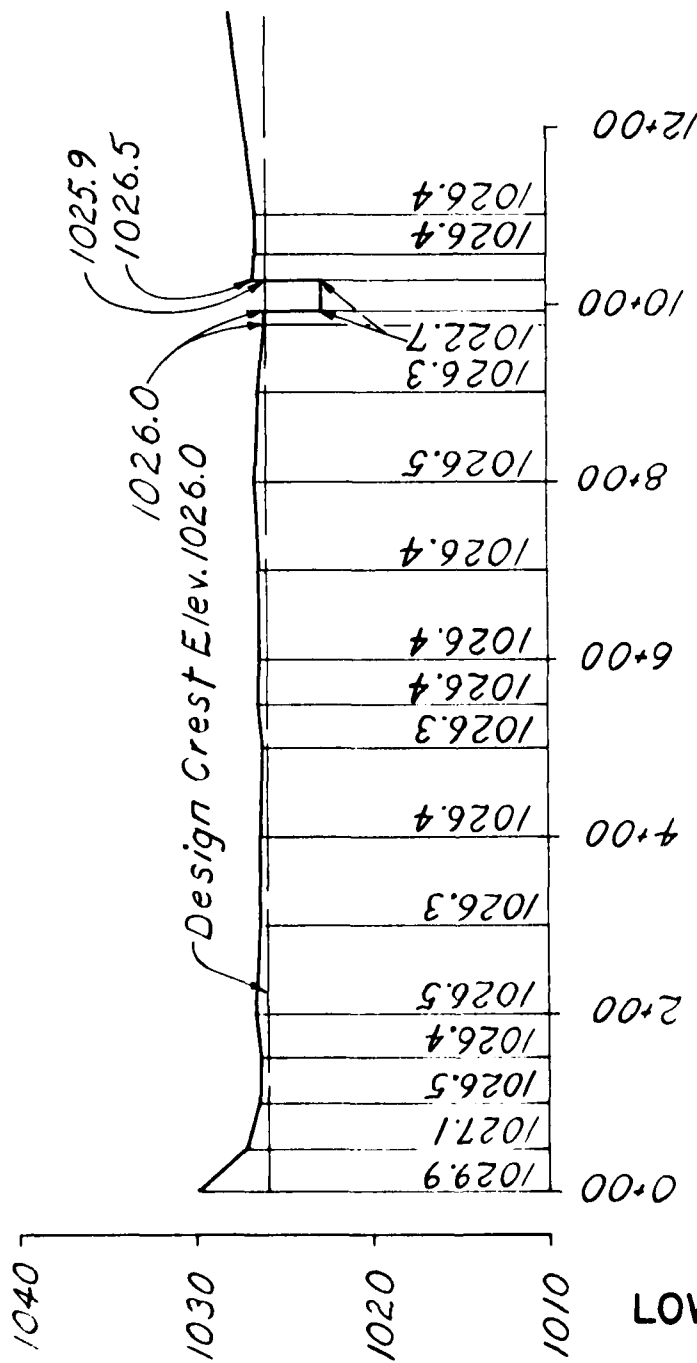
	OBSERVATIONS AND REMARKS
<u>INSTRUMENTATION</u>	
Monumentation	None.
Observation Wells	None.
Weirs	None.
Piezometers	None.
Staff Gauge	None.
Other	None.
<u>RESERVOIR</u>	
Slopes	Flat, wooded with homes.
Sedimentation	Some siltation reported.
Watershed Description	Wooded residential development.
<u>DOWNSTREAM CHANNEL</u>	
Condition	First stone lined, then natural stream. Good condition. Rock lined. Passes through 8'-0" arch under state highway.
Slopes	Wooded, stable.
Approximate Population	10 persons and state park.
No. Homes	3 homes just below the dam near the left abutment. State park about 1/2 mile downstream.



Surveyed 4-1-80

SCHEMATIC PLAN

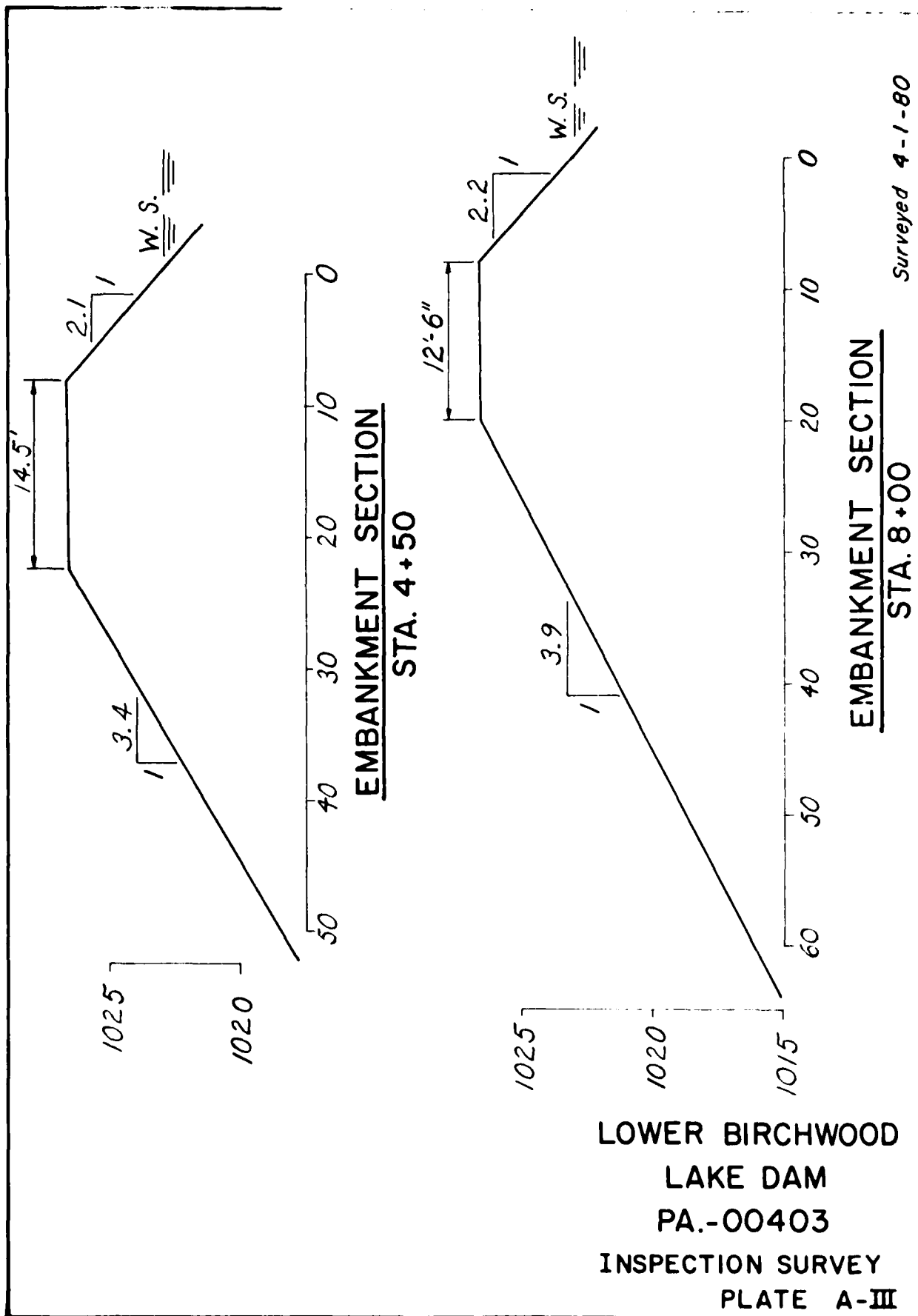
**LOWER BIRCHWOOD
LAKE DAM
PA.-00403
INSPECTION SURVEY
PLATE A-I**



**EMBANKMENT PROFILE
(LOOKING DOWNSTREAM)**

**LOWER BIRCHWOOD
LAKE DAM
PA.- 00403
INSPECTION SURVEY
PLATE A-II**

Surveyed 4-1-80



APPENDIX B
CHECKLIST OF ENGINEERING DATA

CHECK LIST
ENGINEERING DATA

PA DER # 52-145

NDI NO. PA-00 403

NAME OF DAM LOWER BIRCHWOOD LAKE DAM

ITEM	REMARKS
AS-BUILT DRAWINGS	None.
REGIONAL VICINITY MAP	U.S.G.S. Quadrangle - Lake Maskenozha, Pa.-NJ See Plate II, Appendix E
CONSTRUCTION HISTORY	Construction started after June 1958 and completed by April 1960. No records.
GENERAL PLAN OF DAM	See Plate III & IV, Appendix E.
TYPICAL SECTIONS OF DAM	See Plate IV, Appendix E.
OUTLETS: PLAN DETAILS CONSTRAINTS DISCHARGE RATINGS	18-inch corrugated metal pipe encased in concrete. See Plate III, Appendix E. None. None.

NDI NO. PA-00403

ENGINEERING DATA

ITEM	REMARKS
RAINFALL & RESERVOIR RECORDS	None.
DESIGN REPORTS	None.
GEOLOGY REPORTS	None.
DESIGN COMPUTATIONS: HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None.
MATERIALS INVESTIGATIONS: BORING RECORDS LABORATORY FIELD	None.
POST CONSTRUCTION SURVEYS OF DAM	None.
BORROW SOURCES	Unknown.

ENGINEERING DATA

ITEM	REMARKS
MONITORING SYSTEMS	None.
MODIFICATIONS	None.
HIGH POOL RECORDS	No records.
POST CONSTRUCTION ENGINEERING STUDIES & REPORTS	None.
PRIOR ACCIDENTS OR FAILURE OF DAM Description: Reports:	None.
MAINTENANCE & OPERATION RECORDS	None.
SPILLWAY PLAN, SECTIONS AND DETAILS	Plate III & IV, Appendix E.

NDI NO. PA-00403

ENGINEERING DATA

ITEM	REMARKS
OPERATING EQUIPMENT, PLANS & DETAILS	Sloping slide gate (18" x 18") on the upstream slope. Plate III, Appendix E.
CONSTRUCTION RECORDS	None, except copy of construction specifications.
PREVIOUS INSPECTION REPORTS & DEFICIENCIES	None.
MISCELLANEOUS	

NDI NO. PA-00 403

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Real estate development, wooded lots.

ELEVATION:

TOP NORMAL POOL & STORAGE CAPACITY: Elev. 1022.75 Acre-Feet 98

TOP FLOOD CONTROL POOL & STORAGE CAPACITY: Elev. 1025.9 Acre-Feet 226

MAXIMUM DESIGN POOL: Elev. 1026

TOP DAM: Elev. 1025.9

SPILLWAY:

a. Elevation 1022.75

b. Type Concrete ogee with double wooden flashboard.

c. Width 25'

d. Length --

e. Location Spillover Right abutment.

f. Number and Type of Gates None.

OUTLET WORKS:

a. Type 18" CMP with slide gate.

b. Location Upstream toe near center of dam.

c. Entrance ~~inverts~~ centerline 1012.1

d. Exit inverts 1010

e. Emergency drawdown facilities Slide gate.

HYDROMETEOROLOGICAL GAGES:

a. Type None.

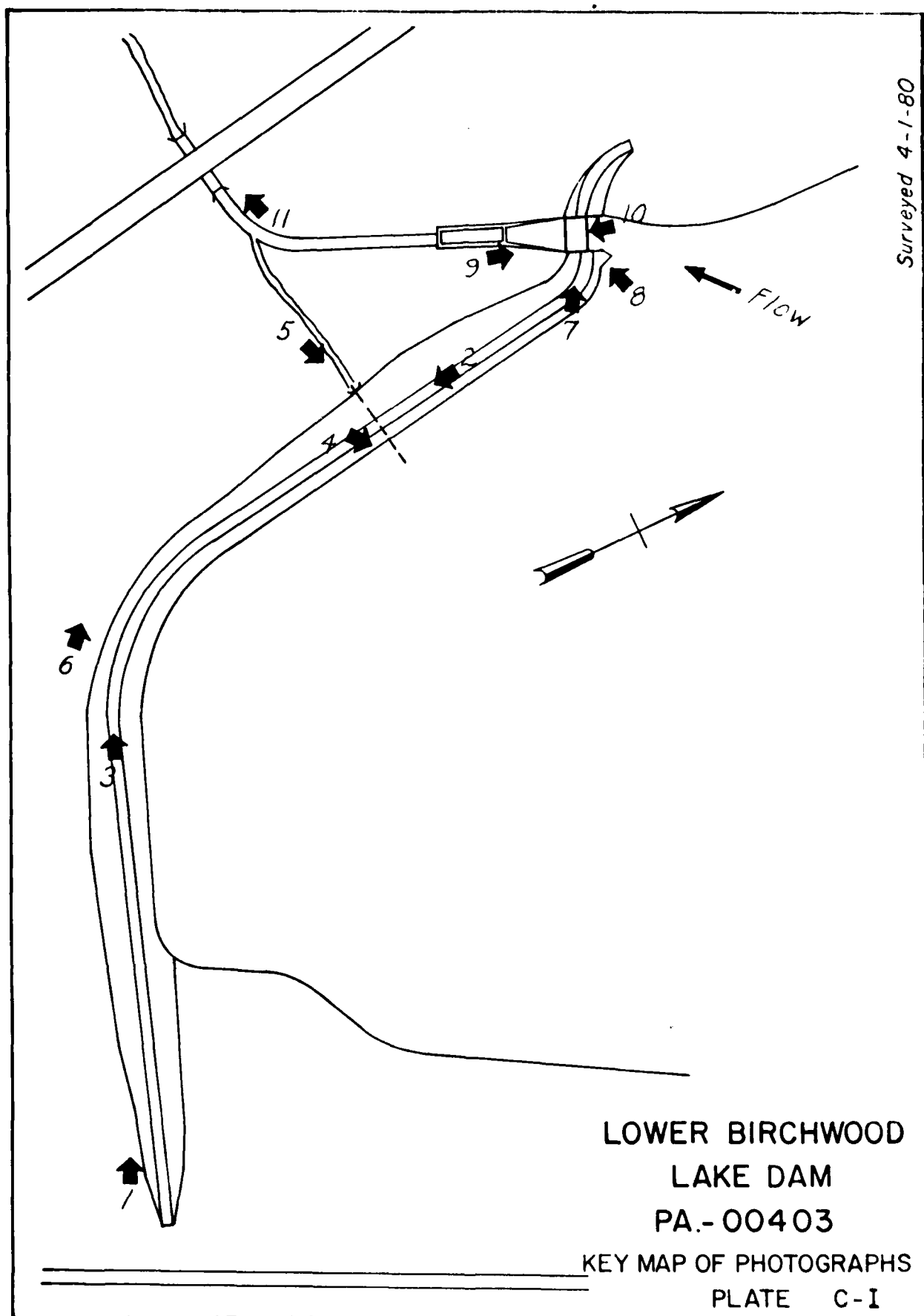
b. Location

c. Records

MAXIMUM NON-DAMAGING DISCHARGE: 461 cfs.

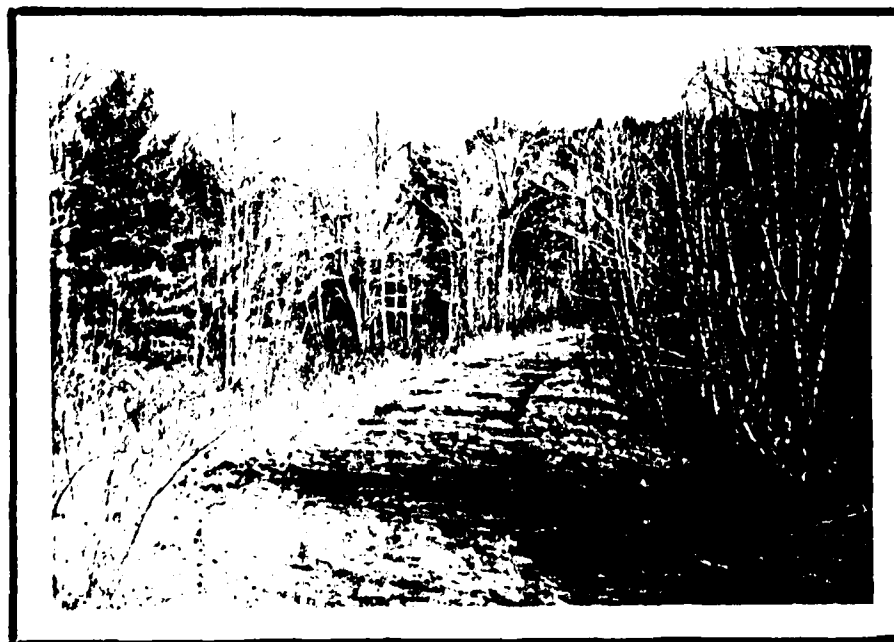
APPENDIX C
PHOTOGRAPHS

APPENDIX C





CREST OF DAM - NO. 2
NOTE: TREES AND BRUSH



CREST OF DAM - NO. 3



SLOPING SLIDE GATE CONTROL - NO. 4



PIPE OUTLET AND HEADWALL - NO. 5



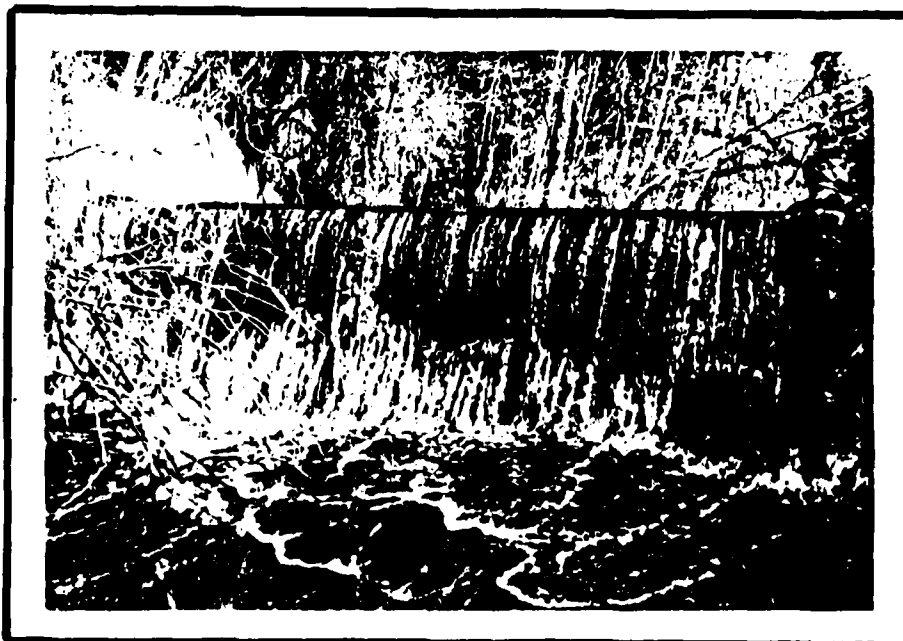
POOL AT DOWNSTREAM TOE - NO. 6



RIGHT ABUTMENT AND SPILLWAY - NO. 7



FLASHBOARDS ON OGEE WEIR - NO. 8



SPILLWAY LOOKING UPSTREAM - NO. 9



DOWNSTREAM CHANNEL - NO. 10



ARCH CULVERT UNDER STATE HIGHWAY - NO. 11

APPENDIX D
HYDROLOGY AND HYDRAULIC CALCULATIONS

SUMMARY DESCRIPTION
OF
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION

The hydrologic and hydraulic evaluation for this inspection report has employed computer techniques using the Corps of Engineers computer program identified as the Flood Hydrograph Package (HEC-1) Dam Safety Version.

The program has been designed to enable the user to perform two basic types of hydrologic analyses: (1) the evaluation of the overtopping potential of the dam, and (2) the capability to estimate the downstream hydrologic-hydraulic consequences resulting from assumed structural failures of the dam. A brief summary of the computation procedures typically used in the dam overtopping analysis is shown below.

- Development of an inflow hydrograph to the reservoir.
- Routing of the inflow hydrograph(s) through the reservoir to determine if the event(s) analyzed would overtop the dam.
- Routing of the outflow hydrograph(s) of the reservoir to desired downstream locations. The results provide the peak discharge and maximum stage of each routed hydrograph at the outlet of the reach.

The output data provided by this program permits the comparison of downstream conditions just prior to a breach failure with that after a breach failure and the determination as to whether or not there is a significant increase in the hazard to loss of life as a result of such a failure.

The results of the studies conducted for this report are presented in Section 5.

For detailed information regarding this program refer to the Users Manual for the Flood Hydrograph Package (HEC-1) Dam Safety Version prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California.

BY RLS DATE 11/1/80

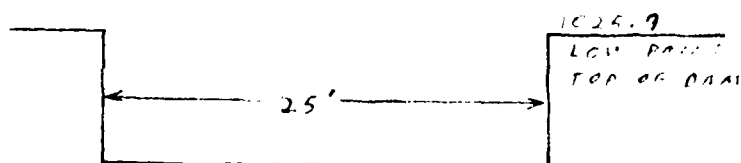
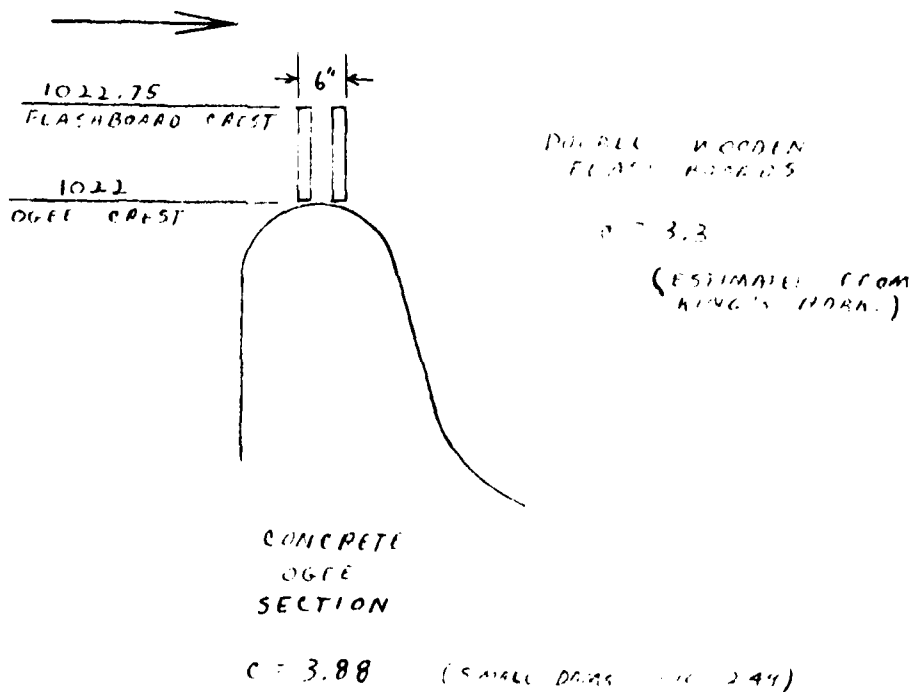
BERGER ASSOCIATES

SHEET NO. 1 OF 8
PROJECT D9650

CHKD. BY DATE

SUBJECT LOWER BIRCHWOOD

SPILLWAY RATING



$$Q = CLH^{3/2}$$

WITH FLASHBOARDS

$$H = 1025.9 - 1022.75 = 3.15'$$

$$Q = 3.3 \times 25 \times (3.15)^{1.5} = 461 \text{ cfs}$$

WITHOUT FLASHBOARDS

$$H = 1025.9 - 1022 = 3.9'$$

$$Q = 3.88 \times 25 \times (3.9)^{1.5} = 747 \text{ cfs}$$

BY RLS DATE 4/7/52

BERGER ASSOCIATES

SHEET NO. OF

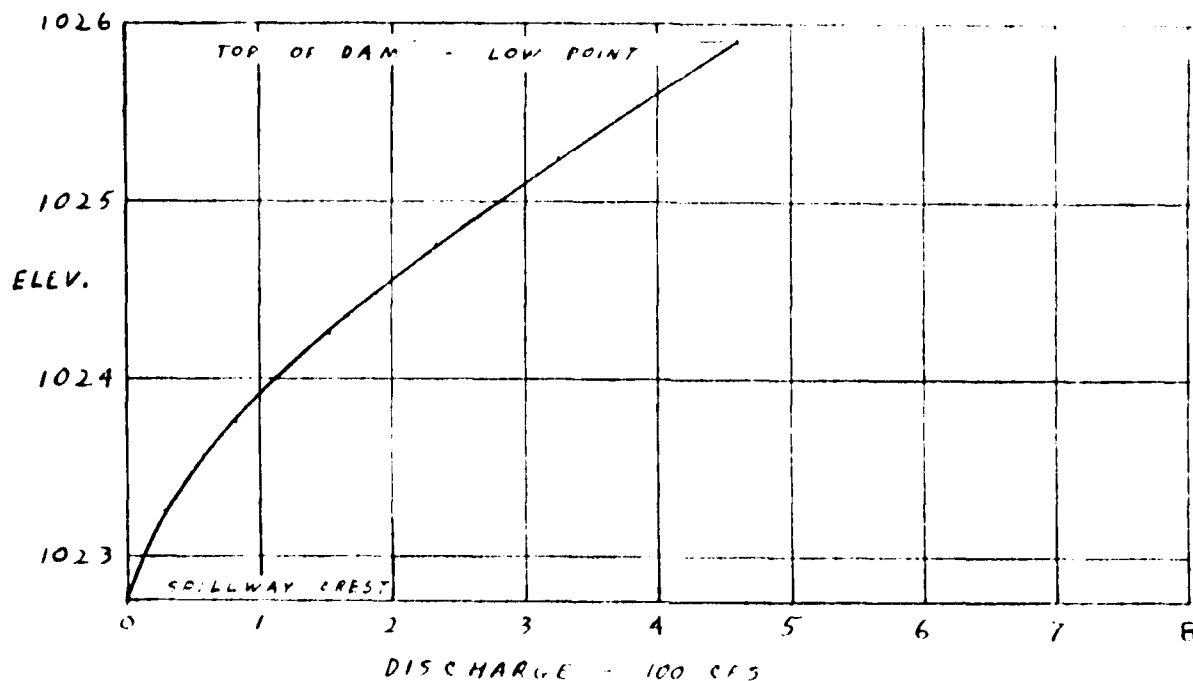
CHKD. BY DATE

PROJECT 07055

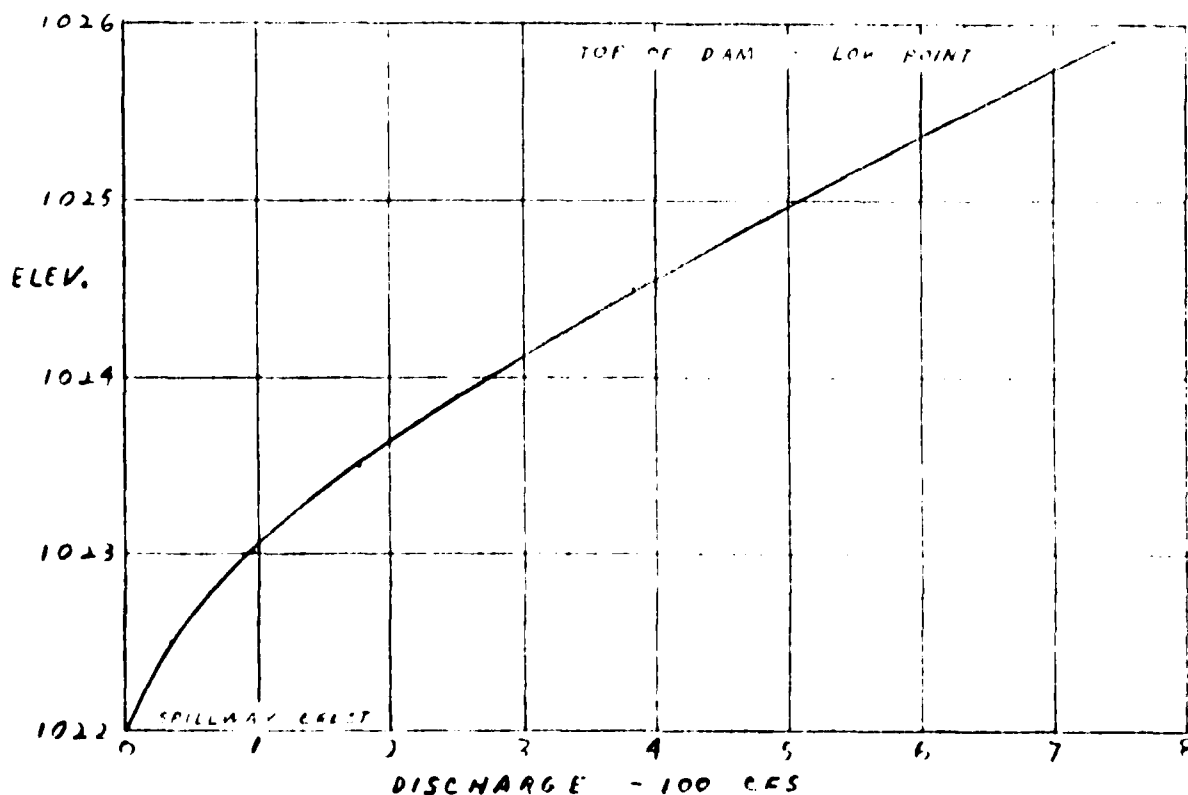
SUBJECT

LOWER BIRCHWOOD

SPILLWAY RATING CURVE (WITH FLASHBOARDS)



SPILLWAY RATING CURVE (WITHOUT FLASHBOARDS)



BY RES DATE 7/1/50

BERGER ASSOCIATES

SHEET NO. 2 OF 11

CHKD. BY DATE

PROJECT D9650

SUBJECT LOWER BIRCHWOOD

EMBANKMENT RATING

Q = CLH ^{3/2}

C 2.7 (UNITED STATES
NATURAL SYSTEM)

AT ELEV. 1026.1

$$2.7 \times 6 \times (.1)^{1.5} = 1$$

$$2.7 \times 2 \times (.1)^{1.5} = 0$$

$$2.7 \times 29 \times (.1)^{1.5} = 1$$

S = 2 CFS

AT ELEV. 1026.3

$$2.7 \times 6 \times (.2)^{1.5} = 3$$

$$2.7 \times 4 \times (.2)^{1.5} = 1$$

$$2.7 \times 80 \times (.15)^{1.5} = 14$$

S = 18 CFS

AT ELEV. 1026.5

$$2.7 \times 6 \times (.5)^{1.5} = 6$$

$$2.7 \times 6 \times (.25)^{1.5} = 2$$

$$2.7 \times 88 \times (.35)^{1.5} = 49$$

$$2.7 \times 100 \times (.05)^{1.5} = 3$$

$$2.7 \times 100 \times (.1)^{1.5} = 9$$

$$2.7 \times 250 \times (.1)^{1.5} = 29$$

$$2.7 \times 200 \times (.1)^{1.5} = 12$$

$$2.7 \times 100 \times (.05)^{1.5} = 3$$

$$2.7 \times 175 \times (.1)^{1.5} = 15$$

S = 143 CFS

AT ELEV. 1027.1

$$2.7 \times 6 \times (1.1)^{1.5} = 19$$

$$2.7 \times 6 \times (.9)^{1.5} = 14$$

$$2.7 \times 98 \times (.7)^{1.5} = 220$$

$$2.7 \times 50 \times (.3)^{1.5} = 22$$

$$2.7 \times 100 \times (.6)^{1.5} = 141$$

$$2.7 \times 100 \times (.2)^{1.5} = 158$$

$$2.7 \times 210 \times (.25)^{1.5} = 438$$

$$2.7 \times 200 \times (.7)^{1.5} = 316$$

$$2.7 \times 100 \times (.6)^{1.5} = 141$$

$$2.7 \times 175 \times (.7)^{1.5} = 272$$

S = 1746 CFS

BY ALS DATE 4/7/80

BERGER ASSOCIATES

SHEET NO. 1 OF 8

CHKD. BY _____ DATE _____

PROJECT D9640

SUBJECT _____

LOWER BIRCHWOOD

DISCHARGE THROUGH OUTLET WORKS

OUTLET CONDUIT = 18" CMP

SLIDE GATE ON UPSTREAM END OF CONDUIT

CENTERLINE OF ENTRANCE ORIFICE = 1012.1
(ESTIMATED FROM DESIGN DRAWINGS)

$$Q = CA \sqrt{2gH} \quad C = 0.6$$

AT NORMAL POOL LEVEL = 1022.75

$$H = 1022.75 - 1012.1 = 10.65$$

$$Q = 0.6 \times 17 \times \frac{(1.5)^2}{4} \times (2 \times 32.2 \times 10.65)^{.5}$$
$$= 28 \text{ CFS}$$

AT LOW POOL LEVEL = 1015

$$H = 1015 - 1012.1 = 2.9$$

$$Q = 0.6 \times 17 \times \frac{(1.5)^2}{4} \times (2 \times 32.2 \times 2.9)^{.5}$$
$$= 19 \text{ CFS}$$

BY ALS DATE 4/21/82 BERGER ASSOCIATES SHEET NO. 5 OF 8
CHKD. BY _____ DATE _____ PROJECT D9650
SUBJECT LOWER BIRCHWOOD

SIZE CLASSIFICATION

MAXIMUM STORAGE = 226 ACRE-Feet

MAXIMUM HEIGHT = 12 FEET

SIZE CLASSIFICATION IS "SMALL"

HAZARD CLASSIFICATION

SEVERAL HOMES ARE LOCATED JUST
DOWNSTREAM OF THE DAM.

USE "HIGH"

RECOMMENDED SPILLWAY DESIGN FLOOD

THE ABOVE CLASSIFICATIONS INDICATE
USE OF AN SDF EQUAL TO ONE-HALF
PMF TO THE PROBABLE MAXIMUM FLOOD

MAXIMUM KNOWN FLOOD AT DAMSITE

THERE ARE NO RECORDS OF POOL LEVELS FOR THIS
DAM. BASED ON THE RECORDS OF THE GAGE STATION
FOR MILL CREEK AT NEARBY MOUNTAIN HOME, PA.
(D.A. = 5.84 SQ. MI) THE MAXIMUM DISCHARGE AT
THE GAGE OCCURRED IN JULY 1969 WHEN A
DISCHARGE OF 1650 CFS WAS OBSERVED. THE
MAXIMUM INFLOW TO LOWER BIRCHWOOD LAKE DAM
IS ESTIMATED TO BE:

$$Q = \left(\frac{1.0}{5.84} \right)^{0.8} \times 1650$$

$$= 402 \text{ CFS}$$

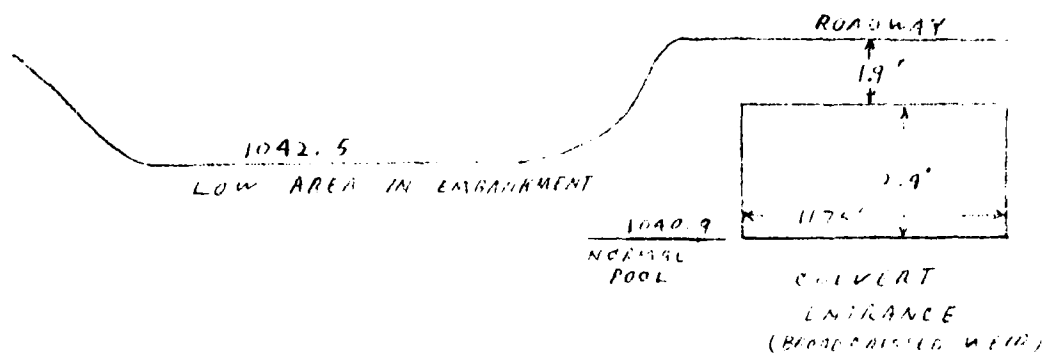
DATE 1/10/80
DRAWN BY
SUBJECT

BERGER ASSOCIATES

SHEET NO. 0 OF 6
PROJECT 11650

LOWER BIRCHWOOD

SPILLWAY OF UPPER BIRCHWOOD



$$Q = C L H^{3/2}$$

$$C = 2.7 \quad (MANKIN'S INDEX)$$

$$H = 1042.5 - 1040.9 = 1.6$$

$$Q = 2.7 \times 11.75 \times (1.6)^{1.5}$$

$$64 \text{ CFS}$$

EARTH EMBANKMENT; FAILURE EXPECTED WITH 0.5 FT OVERTOPPING

BY RLS DATE 11/1/57

BERGER ASSOCIATES

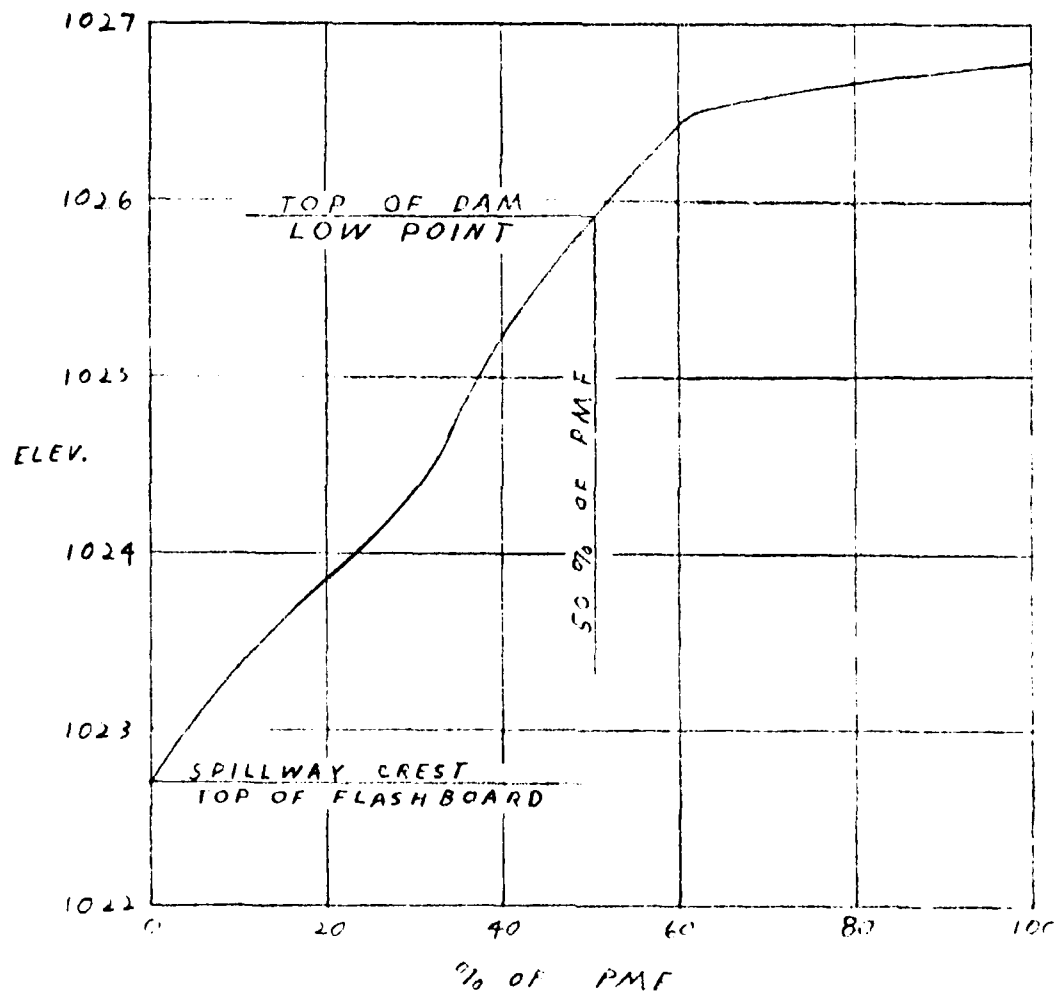
SHEET NO. 1 OF 1

CHECKED BY DATE

PROJECT 27650

SUBJECT TOMPKINS FLASHING

SPILLWAY CAPACITY CURVE (EUSING)



DATE 4/22/80

BERGER ASSOCIATES

SHEET NO. 8 OF 8

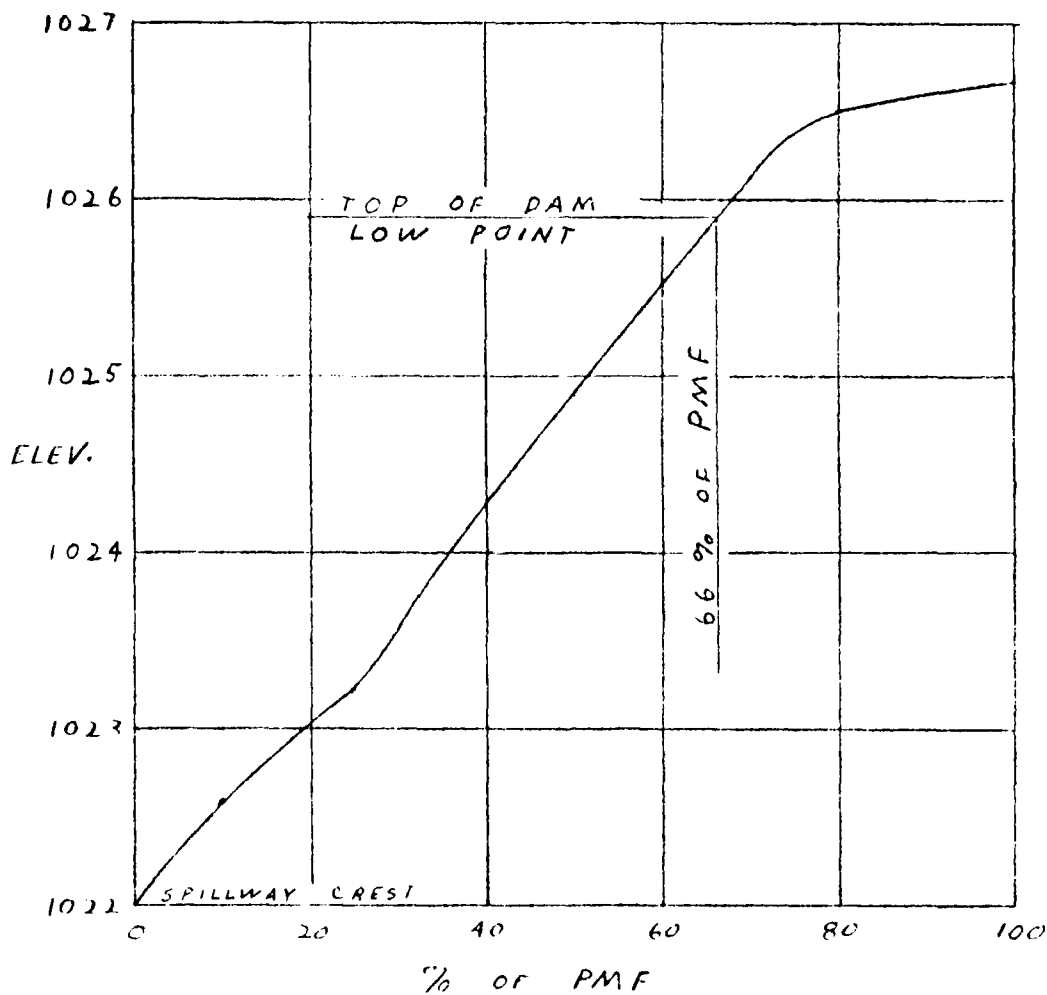
CHKD. BY DATE

PROJECT D 9650

SUBJECT

LOWER BILLY H. OGD

SPILLWAY CAPACITY CURVE (WITHOUT FLASH ROADS)



HYDROLOGY AND HYDRAULIC ANALYSIS DATA BASE

NAME OF DAM: LOWER BIRCHWOOD LAKE RIVER BASIN: DELAWARE
PROBABLE MAXIMUM PRECIPITATION (PMP) = 21.9 INCHES/24 HOURS ⁽¹⁾

(FOR FOOTNOTES SEE NEXT PAGE)

STATION		1	2	3	4
STATION DESCRIPTION		UPPER BIRCHWOOD LAKE	UPPER BIRCHWOOD LAKE DAM	LOWER BIRCHWOOD LAKE	LOWER BIRCHWOOD LAKE DAM
DRAINAGE AREA (SQUARE MILES)		.73		.24	
CUMULATIVE DRAINAGE AREA (SQUARE MILE)		.73	.73	.97	.97
ADJUSTMENT OF PMP FOR DRAINAGE AREA (%) ⁽²⁾	6 HOURS	111		111	
	12 HOURS	123		123	
	24 HOURS	132		132	
	48 HOURS	142		142	
	72 HOURS	-		-	
	Zone 1				
SNYDER HYDROGRAPH PARAMETERS	ZONE ⁽³⁾	1		1	
	C_p / C_t ⁽⁴⁾	.45/1.23		.45/1.23	
	L (MILES) ⁽⁵⁾	1.44		.78	
	L_{co} (MILES) ⁽⁵⁾	.59		.28	
	$T_p = C_t (L \cdot L_{co})^{0.3}$ (hours)	1.17		.78	
SPILLWAY DATA	CREST LENGTH (FT.)		11.75		25
	FREEBOARD (FT.)		1.6		3.15
	DISCHARGE COEFFICIENT		2.7		3.3
	EXPONENT		1.5		1.5
	ELEVATION		1040.9		1022.75
AREA ⁽⁶⁾ (ACRES)	NORMAL POOL		19.6		38.4
	ELEV. _____	1060	126	1040	68.7
	ELEV. _____				
STORAGE AREA - FEET ⁽⁷⁾	NORMAL POOL		117.6		98
	FLEV. _____ ⁽⁸⁾	1022.9	0	1015.1	0
	ELEV. _____ ⁽⁸⁾				
	ELEV _____ ⁽⁸⁾				

- (1) Hydrometeorological Report 33 (Figure 1), U.S. Army, Corps of Engineers, 1956.
- (2) Hydrometeorological Report 33 (Figure 2), U.S. Army, Corps of Engineers, 1956.
- (3) Hydrological zone defined by Corps of Engineers, Baltimore District, for determining Snyder's Coefficients (C_p and C_t).
- (4) Snyder's Coefficients.
- (5) L = Length of longest water course from outlet to basin divide.
 L_{ca} = Length of water course from outlet to point opposite the centroid of drainage area.
- (6) Planimetered area encompassed by contour upstream of dam.
- (7) PennDER files.
- (8) Computed by conic method.

1	A1	UPPER BIRCHWOOD LAKE DAM - 1974 - FLOODING TO 100% OF DESIGN									
2	A2	DELAWARE TWP., PIKE COUNTY, PA.									
3	A3	NDI # PA-00403 PA DER # 52-140									
4	B	300	0	15	0	0	0	0	0	-4	0
5	B1	5									
6	J	1	9	1							
7	J1	1	.9	.8	.7	.6	.5	.4	.25	.1	
8	K		1					1			
9	K1	INFLOW HYDROGRAPH UPPER BIRCHWOOD DAM SUBAREA									
10	H	1	1	.73		.57					
11	P		21.9	111	123	133	142				
12	T							1	.05		
13	W	1.17	.45								
14	X	-1.5	.05	2							
15	N	1	2					1			
16	N1	RESERVOIR ROUTING - UPPER BIRCHWOOD DAM									
17	Y			1							
18	Y1	1					117.6	-1			
19	Y41040.9	1041.4	1041.9	1042.5	1043	1043.5	1044	1044.5	1045.2		
20	Y5	0	11	32	64	450	1212	2215	3483	5703	
21	SA	0	19.6	126							
22	SE1022.9	1040.9	1060								
23	SE1040.9										
24	SE1042.5										
25	K		3					1			
26	K1	INFLOW HYDROGRAPH LOWER BIRCHWOOD LAKE SUBAREA									
27	H	1	1	.24		.97					
28	P		21.9	111	123	133	142				
29	T							1	.05		
30	W	.78	.45								
31	X	-1.5	-.05	2							
32	N	2	4					1			
33	N1	COMBINE HYDROGRAPHS									
34	N	1	5					1			
35	N1	RESERVOIR ROUTING - LOWER BIRCHWOOD LAKE DAM									
36	Y			1							
37	Y1	1					98	-1			
38	Y41022.7	1023.25	1023.75	1024.25	1024.75	1025.25	1025.9	1026.3	1026.5	1027.1	
39	Y5	0	29	82	152	233	326	461	570	742	2454
40	SA	0	38.4	68.7							
41	SE1015.1	1022.75	1040								
42	SE1022.7										
43	SE1025.9										
44	K	99									

1

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT	1
ROUTE HYDROGRAPH TO	2
RUNOFF HYDROGRAPH AT	3
COMBINE 2 HYDROGRAPHS AT	4
ROUTE HYDROGRAPH TO	5
END OF NETWORK	

FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 77

RUN DATE: 80/04/22.

/ /

$$P(10) = \frac{1}{2} P(10) + \frac{1}{2} P(10)$$

UNCLAS FROTH OFFER DISCLOSED BY: [REDACTED]

01-0794 2416

15 JUL 1954

Received by Special Agent in Charge [redacted] 09-15-2000

1975-1976

1001 HARBORVIEW DRIVE

[illegible]

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1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 2676, 2677, 2678, 26

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1. 2.

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH LOWER BIRCHWOOD LAKE SUBAREA

ISTAN	ICOMF	IECON	ITAFE	JFLT	JFAT	INAME	ISTAGE	IAUTH
3	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

INHYG	IUNG	TAKA	CHAF	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	.24	0.00	.97	0.00	0.000	0	0	0

PRECIP DATA

SFE	PM	PE	R12	R24	R48	R72	R96
0.00	21.90	111.00	123.00	133.00	142.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LRDPT	STR-R	DLINK	RTICK	ERAIN	STR-S	RTICK	STR-L	DNSTL	ALOMX	RTIME
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TF= .78 CP= .45 NTA= 0

RECESSION DATA

STRIO= -1.50 ORCSN= -.05 RTIOK= 2.00

UNIT HYDROGRAPH 28 END-OF-PERIOD ORDINATES, LAG= .78 HOURS, CP= .45 VOL= 1.00

13.	47.	80.	88.	73.	59.	48.	39.	32.	28.
21.	17.	14.	12.	9.	8.	6.	5.	4.	3.
3.	2.	2.	1.	1.	1.	1.	1.		

0

END-OF-PERIOD FLOW

HY.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	HY.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
-------	-------	--------	------	------	------	--------	-------	-------	--------	------	------	------	--------

SUM 24.60 20.49 2.47 14.04
(632.)(571.)(61.)(394.87)

COMBINE HYDROGRAPHS

COMBINE HYDROGRAPHS

ISTAN	ICOMF	IECON	ITAFE	JFLT	JFAT	INAME	ISTAGE	IAUTH
4	1	0	0	0	0	1	0	0

HYDROGRAPH ROUTING

RESERVOIR ROUTING - LOWER BIRCHWOOD LAKE DAM

ISTAN	ICOMF	IECON	ITAFE	JFLT	JFAT	INAME	ISTAGE	IAUTH
5	1	0	0	0	0	1	0	0

ROUTING DATA

HYDROGRAPH ROUTING

RESERVOIR ROUTING - LOWER BIRCHWOOD LAKE DAM

ISTAQ	ICOMP	IECON	ITAFI	JPLI	JPRT	INAME	ISTAGE	IAUTO
5	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	0	0	0	0

NSTPS	NSTD	LAG	AM5A	X	TSK	STOKA	ISFRAT
1	0	0	0.000	0.000	0.000	98.	-1

STAGE	1022.70	1023.25	1023.75	1024.25	1024.75	1025.25	1025.90	1026.30	1026.50	1027.10
FLOW	0.00	29.00	82.00	152.00	233.00	326.00	461.00	570.00	742.00	2494.00
SURFACE AREA=	0.	38.	69.							
CAPACITY=	0.	98.	1009.							
ELEVATION=	1015.	1023.	1040.							

CFEL	SFWID	COOW	EXFW	ELEH	COOL	CAREA	EXFL
1022.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOFET	COOD	EXFD	DAMWID
1025.9	0.0	0.0	0.

PEAK OUTFLOW IS 1572. AT TIME 42.25 HOURS

PEAK OUTFLOW IS 1393. AT TIME 42.25 HOURS

PEAK OUTFLOW IS 1209. AT TIME 42.50 HOURS

PEAK OUTFLOW IS 990. AT TIME 42.75 HOURS

PEAK OUTFLOW IS 681. AT TIME 44.00 HOURS

PEAK OUTFLOW IS 457. AT TIME 44.75 HOURS

PEAK OUTFLOW IS 325. AT TIME 45.00 HOURS

PEAK OUTFLOW IS 129. AT TIME 45.50 HOURS

PEAK OUTFLOW IS 40. AT TIME 45.25 HOURS

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
 FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
 AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS								
				RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6	RATIO 7	RATIO 8	RATIO 9
				1.00	.90	.80	.70	.60	.50	.40	.25	.10
HYDROGRAPH AT	1	.73	1	1910.	1719.	1528.	1337.	1146.	955.	764.	472.	191.
	(	1.89)	(	54.07)	(48.67)	(43.26)	(37.65)	(32.44)	(27.04)	(21.63)	(13.52)	(5.41)
ROUTED TO	2	.73	1	1166.	1033.	905.	763.	609.	439.	321.	117.	34.
	(	1.89)	(	33.02)	(29.39)	(25.63)	(21.60)	(17.24)	(12.43)	(9.09)	(3.31)	(.97)
HYDROGRAPH AT	3	.24	1	782.	704.	626.	547.	459.	391.	313.	191.	78.
	(	.62)	(	22.14)	(19.93)	(17.71)	(15.50)	(13.28)	(11.07)	(8.86)	(5.54)	(2.21)
2 COMBINED	4	.97	1	1574.	1398.	1217.	1022.	868.	611.	442.	233.	81.
	(	2.51)	(	44.58)	(39.60)	(34.47)	(28.93)	(22.89)	(17.30)	(12.51)	(6.59)	(2.69)
ROUTED TO	5	.97	1	1572.	1393.	1209.	990.	631.	457.	325.	128.	40.
	(	2.51)	(	44.51)	(39.46)	(34.23)	(28.04)	(19.27)	(12.93)	(9.20)	(3.63)	(1.15)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1		ELEVATION	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM		
		1040.90		1040.90	1042.50		
	STORAGE	119.		118.	256.		
	OUTFLOW	0.		0.	64.		
RATIO	MAXIMUM	MAXIMUM	MAXIMUM	MAXIMUM	DURATION	TIME OF	TIME OF
OF	RESERVOIR	DEPTH	STORAGE	OUTFLOW	OVER TOP	MAX OUTFLOW	FAILURE
PMF	W.S.ELEV	OVER DAM	AC-FT	CFS	HOURS	HOURS	HOURS
1.00	1043.47	.97	513.	1166.	17.00	43.00	0.00
.90	1043.39	.87	484.	1033.	16.25	43.00	0.00
.80	1043.30	.80	455.	905.	15.75	43.00	0.00
.70	1043.21	.71	426.	763.	14.75	43.25	0.00
.60	1043.10	.60	395.	609.	14.00	43.25	0.00
.50	1042.99	.49	364.	439.	12.75	43.50	0.00
.40	1042.83	.33	313.	321.	11.25	43.75	0.00
.25	1042.57	.27	169.	117.	6.50	45.00	0.00
.10	1041.94	0.00	17.	34.	0.00	45.50	0.00

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1		ELEVATION	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
		1022.75		1022.70	1025.90
	STORAGE	29.		96.	226.
	OUTFLOW	3.		0.	461.

RATIO MAXIMUM MAXIMUM MAXIMUM MAXIMUM DURATION TIME OF TIME OF

PLAN 1

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1022.70	1022.70	1025.90
STORAGE	9.	98.	228.
OUTFLOW	3.	0.	461.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1026.78	.88	265.	1072.	9.00	42.25	0.00
.90	1026.72	.82	263.	1053.	8.50	42.25	0.00
.80	1026.66	.76	260.	1039.	7.75	42.10	0.00
.70	1026.53	.69	252.	990.	6.75	42.75	0.00
.60	1026.43	.53	250.	681.	5.25	44.10	0.00
.50	1025.88	0.00	226.	482.	0.00	44.75	0.00
.40	1025.24	0.00	138.	120.	0.00	45.00	0.00
.25	1024.08	0.00	100.	120.	0.00	45.00	0.00
.10	1023.36	0.00	122.	40.	0.00	45.25	0.00

EOT ENCOUNTERED.
N2

1. 100% FINE COTTON

NDI # FA-00403

90 MCM 4192

MULTI-PLAY ANALYSES TO BE PERFORMED

NFLAM= 1 PERIOD= 6 CRTIO= 1

9T105= 1.00 .90 .80 .70 .60 .50 .40 .30 .10

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[illegible]

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH AFTER FIRCHWOOD DAM SUPAREA

ISTAQ	ICOMP	IECON	IHAPE	JFLT	JPR1	IRAME	ISTAGE	IAUT
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

1910G	1980	TAREA	SLOP	TESTA	TESTC	RATIO	ISHOW	ISAME	LOCAL
1	1	.73	0.00	.97	0.00	0.000	0	0	0

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SEFE	FMS	66	612	624	648	612	676
0.00	21.90	111.00	123.00	137.00	142.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOS ANGELES

ENT	STAIR	DATA	RTIME	STAIR	RTIME	STAIR	RTIME	ENTR	ASR	RTIME
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

DATA

IF= 1.17 CF = .15 NTA= 0

EXPERIMENTAL DATA

STRIQ= -1.50 06031 .05 RTIOR= 2.00

NET HYDROGRAPH 43 END-OF-PERIOD ESTIMATE, LAG: 1.18 HOURS, CF: .45 VOL: 1.00

1.	57.	111.	168.	178.	143.	147.	118.	113.	55.
2.	28.	87.	53.	11.	46.	40.	39.	38.	27.
3.	20.	19.	14.	14.	12.	11.	8.	7.	10.
4.	6.	5.	4.	4.	3.	3.	2.	2.	2.
5.	1.	1.							

END OF PERIOD FLOW

[illegible]

100 24.0 27.0 28.0 29.0
+ 632.00 671.00 681.00 693.00

RESERVOIR ROUTING

RESERVOIR ROUTING - DRAIN FLOOD DAM

ISTAG	ICDHF	ICDHF	ICDHF	ICDHF	ICDHF	ICDHF	ICDHF	ICDHF
2	1	0	0	0	0	0	1	0
ROUTING DATA								
QLOSS	CLOSS	AUG	IPES	ISDH	IOPT	IFHE	LSTR	
0.0	0.000	0.00	1	0	0	0	0	

NSIPS	NSIDE	LOS	ANCL	X	ISL	STOR	ISPRAT
1	0	0	0.000	0.000	0.000	118.	-1

STAGE	1040.70	1041.40	1041.90	1042.50	1043.00	1043.50	1044.00	1044.50	1045.00
FLOW	0.00	11.00	32.00	64.00	150.00	1212.00	2215.00	3400.00	5700.00
SURFACE AREA=	0.	20.	12600.						
CAPACITY=	0.	118.	83625.						
ELEVATION=	1023.	1041.	1060.						

QACL	SPWD	COOW	EXW	ELEUL	COOL	CKEA	EXPL
1040.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0

USE DATA			
TIME	QACL	EXW	DAWEL
1042.5	0.0	0.0	0.

PEAK OUTFLOW IS 1166. AT TIME 43.00 HOURS

PEAK OUTFLOW IS 1321. AT TIME 43.00 HOURS

PEAK OUTFLOW IS 1401. AT TIME 43.00 HOURS

PEAK OUTFLOW IS 783. AT TIME 43.25 HOURS

PEAK OUTFLOW IS 609. AT TIME 43.25 HOURS

PEAK OUTFLOW IS 439. AT TIME 43.50 HOURS

PEAK OUTFLOW IS 309. AT TIME 43.75 HOURS

PEAK OUTFLOW IS 117. AT TIME 44.00 HOURS

PEAK OUTFLOW IS 0. AT TIME 44.00 HOURS

SUB AREA INPUT DATA

INLOW HYDROGRAPH (12) 1 1 1 1 1 1 1 1 1 1 1 1

ISTAD	ICOMP	IRAIN	IRATE	IRIT	IRF	IRV	IRL	IRTA	IR
3	0	0	0	0	0	0	1	1	1

HEAD DATA

IRHDS	IRHDS	IRHDS	IRHDS	IRHDS	IRHDS	IRHDS	IRHDS	IRHDS	IRHDS
1	1	.24	0.00	.77	0.00	0.000	0	0	1

IRHDS DATA

IRHDS	IRHDS	IRHDS	IRHDS	IRHDS	IRHDS	IRHDS	IRHDS	IRHDS	IRHDS
0.00	21.90	111.00	113.00	113.00	142.00	0.00	0.00		

TASFC COMPUTED BY THE PROGRAM IS .4500

LOSS DATA

LOSS	LOSS	LOSS	LOSS	LOSS	LOSS	LOSS	LOSS	LOSS	LOSS
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.00	0.00

IRHDS HYDROGRAPH DATA

IRHDS = 1.00 IRHDS = 1.00 IRHDS = 0

IRHDS DATA

IRHDS = -1.50 IRHDS = -1.00 IRHDS = 2.00

INLET HYDROGRAPH OF END-OF-PERIOD (IRHDS) DATA (12) 1 1 1 1 1 1 1 1 1 1 1 1

IRHDS	IRHDS	IRHDS	IRHDS	IRHDS	IRHDS	IRHDS	IRHDS	IRHDS	IRHDS
1.	12.	20.	21.	21.	21.	21.	21.	21.	21.
11.	12.	14.	12.	8.	8.	8.	8.	4.	3.
3.	2.	2.	1.	1.	1.	1.	1.	1.	

END-OF-PERIOD FLOW

MO.1	MO.2	MO.3	MO.4	MO.5	MO.6	MO.7	MO.8	MO.9	MO.10	MO.11	MO.12

IRHDS = 1.00 IRHDS = 1.00 IRHDS = 1.00
IRHDS = 1.00 IRHDS = 1.00 IRHDS = 1.00

END-OF-PERIOD FLOW

END-OF-PERIOD FLOW

IRHDS	IRHDS	IRHDS	IRHDS	IRHDS	IRHDS	IRHDS	IRHDS	IRHDS	IRHDS
4	2	0	0	0	0	1	0	0	0

END-OF-PERIOD FLOW

END-OF-PERIOD FLOW

IRHDS	IRHDS	IRHDS	IRHDS	IRHDS	IRHDS	IRHDS	IRHDS	IRHDS	IRHDS
5	1	0	0	0	0	1	0	0	0

END-OF-PERIOD FLOW

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
 FLOWS IN CUBIC FEET PER SECOND (CUMIC METERS PER SECOND)
 AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS								
				RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6	RATIO 7	RATIO 8	RATIO 9
				1.00	.90	.80	.70	.60	.50	.40	.25	.10
HYDROGRAPH AT	1	.73	1	1910.	1717.	1528.	1337.	1146.	955.	764.	477.	191.
	(	1.89)	(	54.07)	48.67)	43.26)	37.65)	32.44)	27.04)	21.63)	13.52)	5.41)
ROUTED TO	2	.73	1	1166.	1038.	905.	763.	609.	439.	321.	117.	34.
	(	1.89)	(	33.02)	29.39)	25.63)	21.60)	17.24)	12.43)	9.09)	3.31)	.97)
HYDROGRAPH AT	3	.24	1	782.	704.	626.	547.	469.	391.	313.	195.	76.
	(	.62)	(	22.14)	19.93)	17.71)	15.50)	13.28)	11.07)	8.86)	5.54)	2.21)
2 COMBINED	4	.97	1	1574.	1358.	1217.	1022.	868.	611.	442.	233.	93.
	(	2.51)	(	44.58)	39.60)	34.47)	28.93)	22.89)	17.30)	12.51)	6.59)	2.69)
ROUTED TO	5	.97	1	1563.	1361.	1067.	822.	645.	477.	340.	174.	48.
	(	2.51)	(	44.25)	38.54)	30.22)	23.28)	18.27)	13.49)	9.62)	3.80)	1.28)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1040.90	1040.90	1042.50
STORAGE	118.	118.	268.
OUTFLOW	0.	0.	64.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1043.47	.97	513.	1166.	17.00	43.00	0.00
.90	1043.39	.89	484.	1038.	16.25	43.00	0.00
.80	1043.30	.80	425.	905.	15.75	43.00	0.00
.70	1043.21	.71	404.	763.	14.75	43.25	0.00
.60	1043.10	.60	386.	609.	14.00	43.25	0.00
.50	1042.99	.49	354.	439.	12.75	43.50	0.00
.40	1042.83	.33	326.	321.	11.25	43.75	0.00
.25	1042.57	.07	262.	117.	6.50	45.00	0.00
.10	1041.94	0.00	177.	34.	0.00	45.50	0.00

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1022.19	1022.00	1023.90
STORAGE	95.	83.	249.
OUTFLOW	12.	0.	747.

RATIO OF	MAXIMUM RESERVOIR	MAXIMUM DEPTH	MAXIMUM STORAGE	MAXIMUM OUTFLOW	DURATION OVER TOP	TIME OF MAX OUTFLOW	TIME OF FAILURE
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PLAN 1

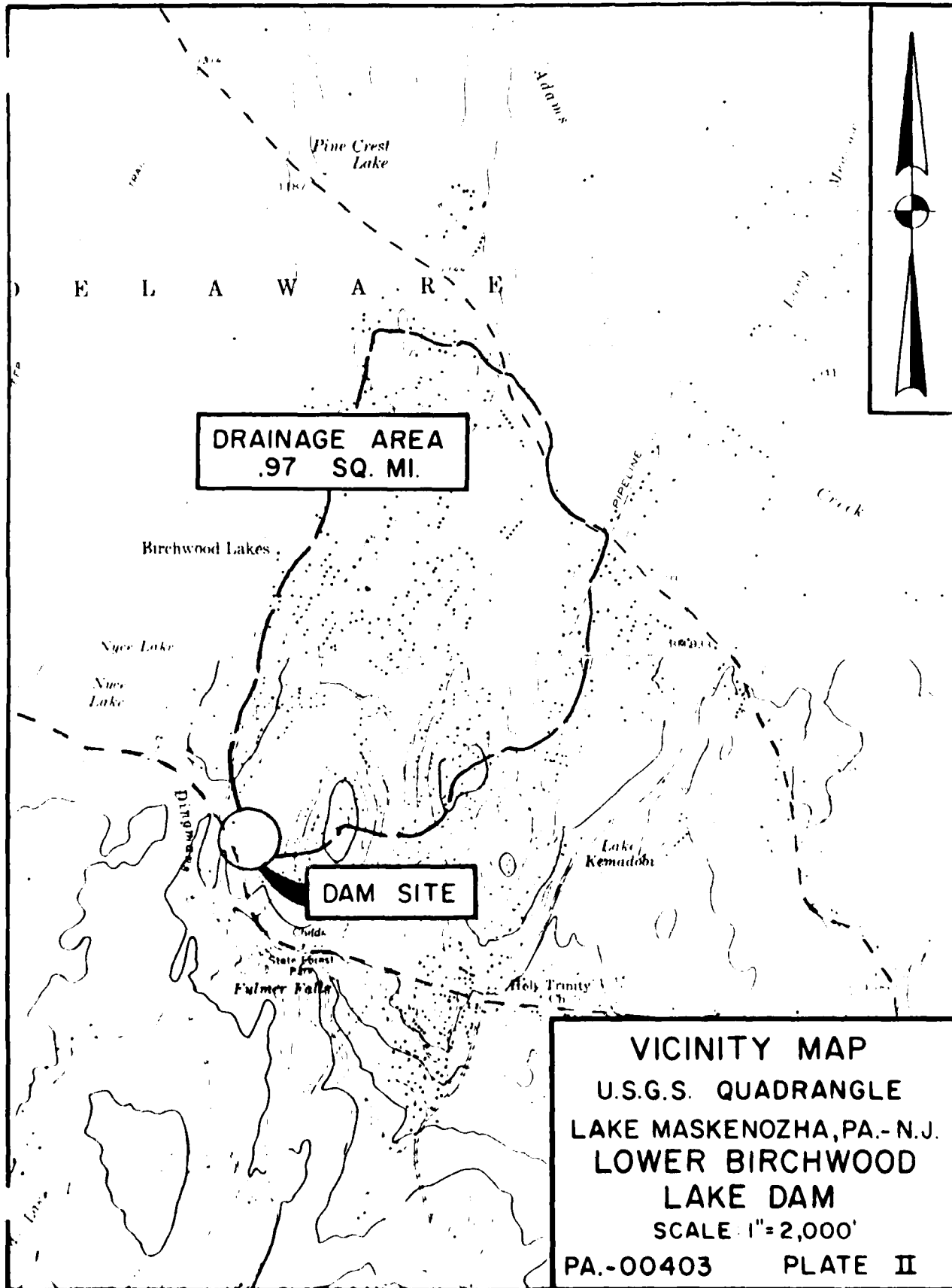
	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1022.18	1022.00	1025.90
STORAGE	95.	65.	249.
OUTFLOW	12.	0.	747.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1026.67	.77	284.	1563.	6.25	42.50	0.00
.90	1026.60	.70	281.	1361.	5.50	42.75	0.00
.80	1026.50	.60	276.	1067.	4.50	43.50	0.00
.70	1026.12	.22	259.	822.	2.50	44.00	0.00
.60	1025.52	0.00	233.	645.	0.00	44.25	0.00
.50	1024.89	0.00	205.	477.	0.00	44.50	0.00
.40	1024.30	0.00	181.	340.	0.00	44.75	0.00
.25	1023.23	0.00	137.	134.	0.00	45.00	0.00
.10	1022.59	0.00	111.	45.	0.00	44.25	0.00

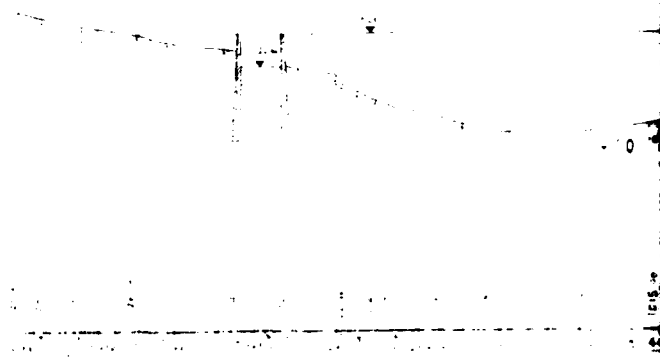
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N>

APPENDIX E

PLATES



PROFILE



PROFILE

PLAN OF DAM

PROFILE OF CENTER LINE OF DAM

Horizontal
Vertical

PROFILE OF WASTEWATER CHANNEL

PROFILE OF CHANNEL FOR FLOOD FLOW

1. The above profile is for the design flood of 100 years return period.
2. The above profile is for the design flood of 100 years return period.

APR 30, 1958
SHEET 45 OF 50

ER LINE OF DAM

ADJUSTED TO
VERTICAL

SWAY CHANNEL

OF CHANNEL THE OTHER SIDE

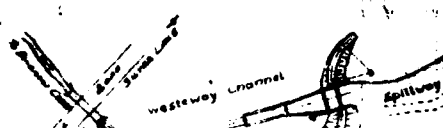
2
1. A. AND B. ARE THE
AND C. ARE THE

4. B. IS THE

DELAWARE
APRIL 30, 1958

SCALES AS SHOWN

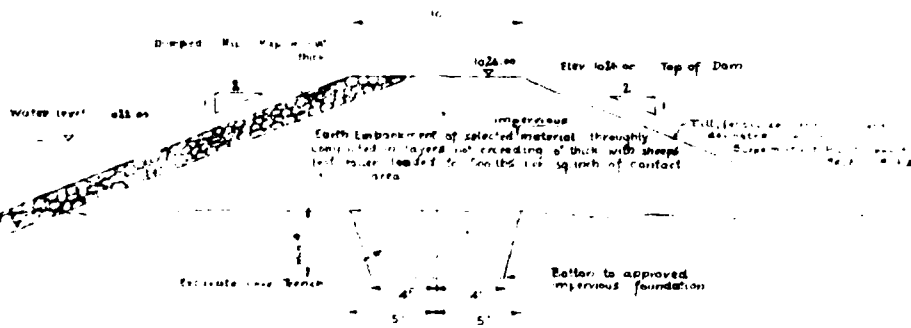
PA-00403
PLATE III



General Plan of DAM Scale 1" = 60'

Edge Swamp
1632 Contour water level 41 1/2 Acres.

Section of Dam in station 5+30



Section A-A along 4 of Spillway



Note: All concrete work to Class A - 10' Depth of Mass Displacement Test 2 1/2' x 4' x 8' except adverse for granite stone mass which shall be 1 part cement, 2 parts sand and 3 parts pea gravel

APPENDIX F
GEOLOGIC REPORT

GEOLOGIC REPORT

Bedrock - Dam and Reservoir

Formation Name: Trimmers Rock Formation.

Lithology: Gray to dark gray interbedded shale, siltstone, and some fine grained sandstone. Beds are one to three feet thick.

Structure

The dam is located near the eastern edge of the Pocono Plateau. The regional strike of the beds is N40°E and the dip is a few degrees to the northwest. Minor folds are superimposed on the regional dip and locally dips as high as 15° occur. No faults are mapped in the vicinity of the dam. Joint sets trending N2° to 13°E and N82°E to N75°W are reported.

Air photo fracture traces trend: N40°W and N15°E.

Overburden

There is no information in the file relative to borings or test pits at this site. It is located within the of Pleistocene glaciation and a variable thickness of till can be expected to be present. Outwash sands and gravels commonly occur in the valleys.

Aquifer Characteristics

The rocks of the Catskill Formation are essentially impermeable and ground water movement is entirely along bedding planes and fractures. The most permeable aquifers in the area are the sands and gravel of the glacial outwash commonly found in the valleys.

Discussion

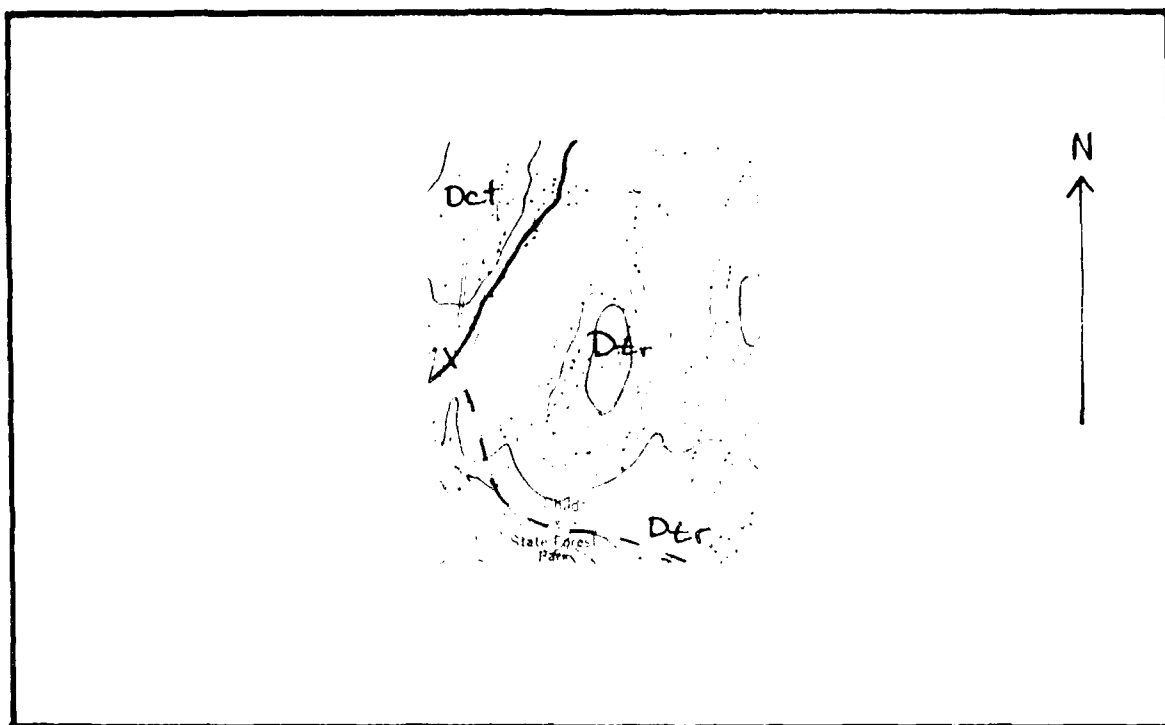
The plans of this dam indicate that a core trench was to be dug into "impervious material" - a minimum of four feet deep. There are no reports indicating the type of material encountered in this trench.

Sources of Information

1. Fletcher, F.W. and Woodrow, Donald L. (1970), "Geology and Economic Resources of the Pennsylvania Portion of the Millford and Port Jervis 15-Minute Quadrangles," Pa. Geologic Survey Atlas 223, Harrisburg, Pa.

2. Sevon, W.D., et al, "Geology and Mineral Resources of Pike County," open file report, Pa. Geologic Survey, Harrisburg, Pa.
3. Air photographs dated 1973, scale 1:40,000.
4. Plans and inspection reports in file.

GEOLOGIC MAP - Lower Birchwood Lake Dam



Det

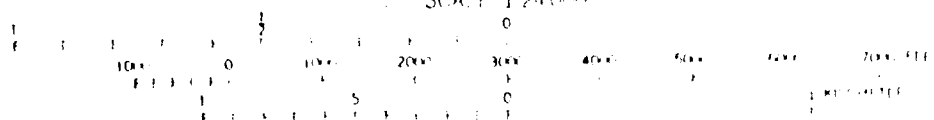
Catskill Fm. - Towamensing member

Dtr

Trimmers Rock Fm.

--- air photo fracture trace

SCALE 1:24,000



CONTOUR INTERVAL 20 FEET